Pit and Quarry

Published Bi-weekly on Wednesday for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and other Non-Metallic Minerals

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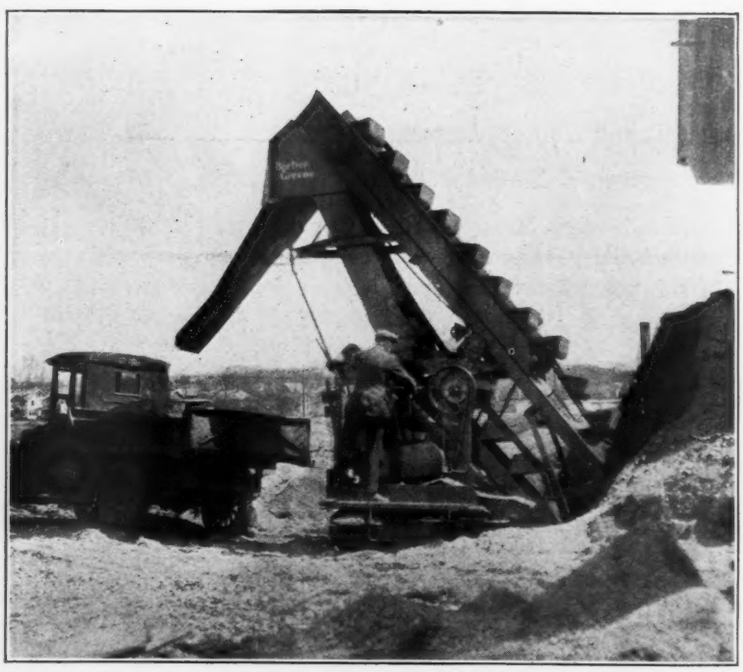
Two Big, Bad Jobs

Loading gravel which contains cobble stones as big as your two fists is one of the tough jobs a Barber-Greene Bucket Loader has licked. And the same Barber-Greene was used to dig hard and frozen material directly from the bank.

Barber-Greene Bucket Loaders are built for such tough jobs. For the sturdy, patented disc-feed, pushed directly from the crawlers, takes all of the heavy digging strains — follows the contour of the ground — and pulls heaping loads of material into the big, wide buckets.

Because the disc-feed keeps the buckets carrying bigger loads *continuously*, trucks can make more trips per day.

"Licked" by Disc Feed



In order that the disc-feed might be pushed directly from the loader chassis to skim the ground for a clean pick-up — to dig into hard banks without damaging the loader — Barber-Greene developed the famous patented Floating Boom. This boom is free to rise or lower without twisting or straining any of the other parts.

And there are many other advantages to B-G Bucket Loaders such as the patented automatic overload spring release, swivel spout, three speed gear shift, full crawlers, large buckets, accurate batch hoppers, dirt proof housing, Buda engine and easy control — all described in the special illustrated catalog, "Loading Layouts." Write for your copy today.

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BARBER-GREENE COMPANY

492 W. Park Avenue, Aurora, Illinois

Pit and Quarry

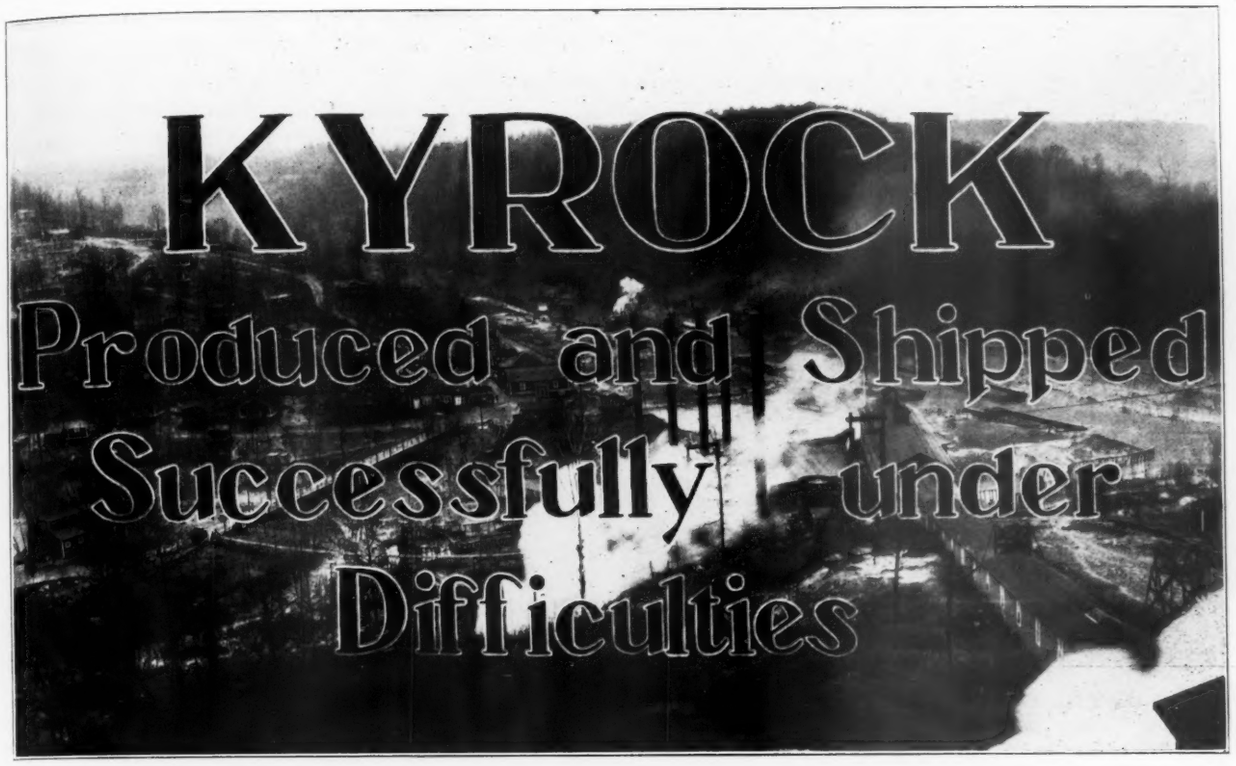
Vol. XVIII CHICAGO, ILL., JUNE 19, 1929 No. 6

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is taken from our files and its selection is without significance as to current events or as to the position of the individual in the industry.

F. W. Stolle

Mr. Stolle is President, Treasurer and General Manager of Casper Stolle Quarry and Contracting Company, East St. Louis, Illinois



Feature of Operation Is Controlled Blending Process Insuring Uniform Bitumen Content

By W. E. TRAUFFER

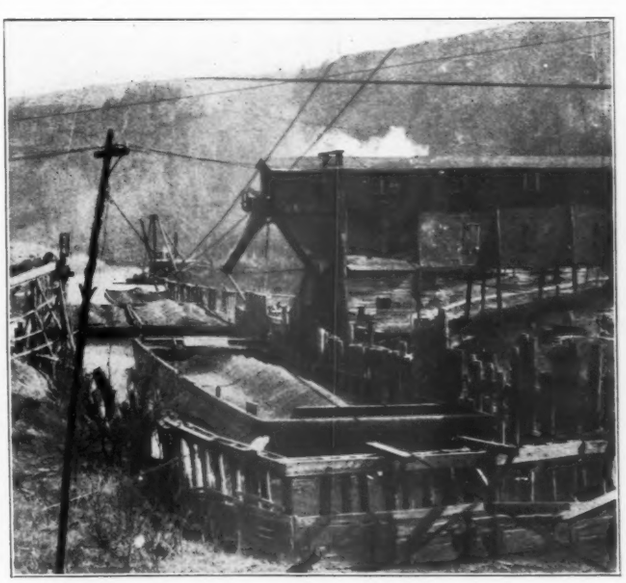
THE operations of the Kentucky Rock Asphalt Company at Kyrock, Kentucky, are among the most unusual and interesting in the non-metallic minerals industry of the United States. The history of this company, the difficulties encountered in mining and shipping its product, and the manner in which these obstacles were overcome alone make a story which would fill many volumes. The widespread use of Kyrock for road construction speaks well for the quality of the product and the efficiency of the plant and personnel behind the product.

Early History

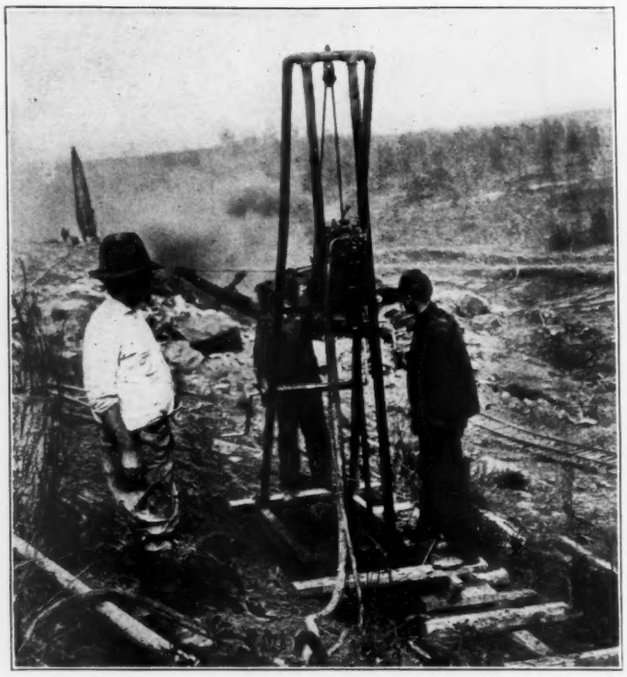
According to a story which has gained considerable credence the rock asphalt which is peculiar to this part of Kentucky was first discovered by the Indians who inhabited the country long before the day of the white man. The story says that they scraped away the asphalt which oozed from cliffs and out-croppings and used it to calk the seams of their canoes. It is also supposed to have been used as a salve for wounds. Certain it is that when the first white settlers penetrated from the east they learned of its uses from the Indians and used the tar to waterproof their boats and cabins.

Stories about this strange substance finally reached the ears of geologists in the East and aroused their curiosity as to the possibility of developing this rich store for commercial use. Because of the inaccessibility of the region, however, it was many years before this was successfully accomplished. In the early 90's a paving company opened up a quarry near Brownsville and became the pioneer in the development of rock asphalt pavement.

Prior to 1910, when the automobile industry was still in its infancy, there was no great demand for hard paving except in cities. The real growth of this industry began when the federal government cleaned up the Green river and its tributaries,



Barge in Slip at Plant Being Loaded with Kyrock.



One of the Blast-Hole Drills Mounted on Skids of the Company's Design

making them navigable and allowing shipment at a low enough rate to enable producers to compete with other forms of hard pavement.

The deposits consist of a rock composed of pure silica sand completely impregnated with natural asphalt with no impurities of any kind. The deposits vary from 20 to 60 feet in depth. The overburden is largely sandstone running up to 50 feet in depth. Geologically these deposits are in the Pottsville sands in the Pennsylvania series.

Formation of the Company

The Kentucky Rock Asphalt Company, Incorporated, opened up its present operations about 1918. The holdings which comprise over 45,000 acres are located in the counties of Edmonson, Grayson, and Hart on a peninsula between the Nolin and Green rivers about 35 miles by air-line from Bowling Green, Kentucky. The entire area has been carefully prospected and plotted and quarry sites mapped for future working. The present maximum production is about 1,500 tons per day.

Since 1918 the output has increased from 40,000 tons per year to over 250,000 tons. It is expected that production in 1929 will exceed 300,000 tons. The plant now operates the year round to fulfill the demand, missing only three or four days in a year. The plant layout is such that additional machinery can be installed whenever necessary to handle a larger output.

Stripping Operations

The four open pits in which the rock asphalt is at present being quarried are all worked in the same manner. The overburden of sandstone which averages from 40 to 50 feet in depth is drilled and blasted by the ordinary bank methods. Eight Ingersoll-Rand Leyner wagon drills and six well drills are used at the various quarries. Of the well drills one, a Sparta, is gasoline-driven and the others, which are Clipper, Keystone and Cyclone, are steam operated. About 2 carloads of explosives of various makes are used per month, most of this being 35 per cent quarry gelatin. Cordeau-Bickford fuse is used exclusively. Twenty Ingersoll-Rand, Sullivan and Chicago jackhammers are used for secondary drilling.

The broken stone is then loaded by steam shovels into 8-yd. Western and Continental side-dump cars

Two Large Steam Shovels Stripping Overburden and Loading Into 8-Yd. Side Dump Cars

and hauled to nearby cliffs where they are dumped. Twenty-four of these cars are in constant use. Four Model 60 Marion railroad type shovels with 2½-yd. dippers are used to load the overburden at the various quarries. A Model 36 Marion revolving caterpillar shovel with a 1½-yd. dipper is also used for this purpose when not required for railroad construction, of which there is almost always some being done.

Quarrying Operations

The commercial rock asphalt in the quarries averages over 20 feet in depth. This is drilled and blasted and broken up by the same methods and with the same equipment as the sandstone overburden. The method of loading, however, is entirely different. The commercial rock is all hand-picked by men who through many years of experience are able to determine at a glance whether or not the bitumen content of any fragment is such as to make it suitable for commercial use. All waste stone is loaded into cars by six Erie Type B caterpillar shovels with ¾-yd. dippers and hauled away to the various dumps. These shovels also clean up after the large stripping shovels.

The commercial rock is loaded into cars from steel skip-boxes handled by Osgood and Erie cranes. These boxes are loaded by hand with the smaller rock. The larger pieces which cannot be loaded in this manner are handled one at a time by cranes and guy derricks. There are 15 of these derricks in operation in the various quarries. All of them use American Steel and Wire Company cables and guy lines, but the steam hoists are of varied makes, including Emerson-Brantingham, J. S. Munday, Buffalo, Lambert, Lidgerwood and Mead-Morrison.

The cars in which the stone is hauled to the plant

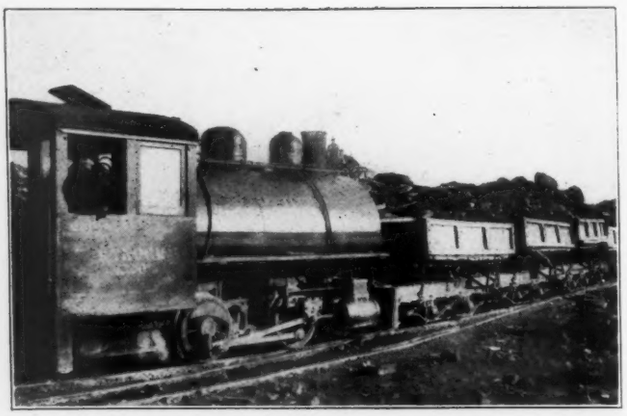
A Portable Gasoline Driven Air Compressor and Drill at One of the Quarries

are Western and Continental 4-yd. side-dump cars. One hundred and twenty-five of these are now being used. All tracks are 36-in. gauge. Twenty steam locomotives are used to haul these cars as well as the cars of waste material. Porter, Baldwin and Vulcan locomotives are used, ranging in size from 14 to 22 tons. About 15 miles of railroad are in use at present, involving cuts as deep as 40 feet and fills as high as 100 feet. Over 20 miles of steam, water and air pipes connect the quarries with the plant. A private telephone system connects all operations with the main office.

The Main Quarry

The quarry which so far has produced most of the material is on top of the hill adjacent to and overlooking the plant. This quarry was opened eleven years ago and will be worked in a small way for an indefinite period. At present two derricks and three cranes are loading material from this

Loading Overburden at the Indian Creek Quarry. Well Drills at Work in Background



One of the 21-Ton Locomotives Hauling a Load of Rock

quarry into cars. The real reason for the slowing up of operations here is due to the fact the same grade of rock with more favorable overburden can be had near-by and three other quarries have been opened up.

The Indian Creek and Sweeden Quarries

The Indian Creek quarry which was opened up last year is one of the richest known deposits. The depth of commercial rock here runs as high as 60 feet. Over 60,000 tons of rock asphalt were quarried here during the past year and this figure is expected to be exceeded this year. This quarry and the new quarry at Beaver Dam are expected to be the main sources of supply for some time to come. The Sweeden quarry has also been in operation for over a year.

The Beaver Dam Quarry

The Beaver Dam quarry, which was recently opened, is the largest deposit yet found. It contains millions of tons of known and tested rock asphalt and is only 3½ miles from the plant by rail. Stripping at this quarry has been going on for some time and actual production is now under way. The mile and a half of railroad connecting this quarry with the main line involved some very heavy work, including a 35-ft. cut through solid rock. The amount of overburden here is very small compared to the other quarries.

Plant Operations

At the plant the cars discharge the rock, which varies from 8-in. to 5-ton pieces, into an Allis-Chalmers Blake 60-in. by 48-in. jaw primary crusher which reduces to 7 inches or under. A 20-ton Chisholm-Moore Cyclone traveling hoist over this crusher handles all oversize rock and repair parts. The crusher discharges onto a 30-in. belt conveyor on 560-ft. centers, which hauls the crushed stone to a 1,000-ton capacity wooden storage bin. This bin has a number of compartments which are loaded alternately by an automatic tripper to blend the material from the various quarries.

Each of these bins has an arrangement of finger gates which allows simultaneous feeding from all of them onto a 100-ft. apron conveyor under the bins. This gives a still further blending of the material. The apron conveyor discharges onto a 130-ft. conveyor which feeds the 22-in. by 50-in. Good Roads secondary jaw crusher. This crusher reduces to 4-in. maximum size and discharges into a rotary screen with 2-in. perforations. The oversize goes to a 52-in. Anaconda crushing roll which reduces to 1½-in. maximum size. The roll discharges onto a series of 3 belt conveyors which feed

Typical Quarry Scene, Showing Steam Shovel Sorting Commercial Rock to Be Loaded Into Cars by the Guy Derrick

to six 42-in. by 16-in. Type B Allis-Chalmers smooth rolls. The material passing through the revolving screen discharges directly onto the same conveyors. The smooth rolls pulverize the material so that 95 per cent will pass through a ½-in. screen. A 50-ft. belt conveyor assembles the material from the finishing rolls and feeds a 216-ft. conveyor to the barges.

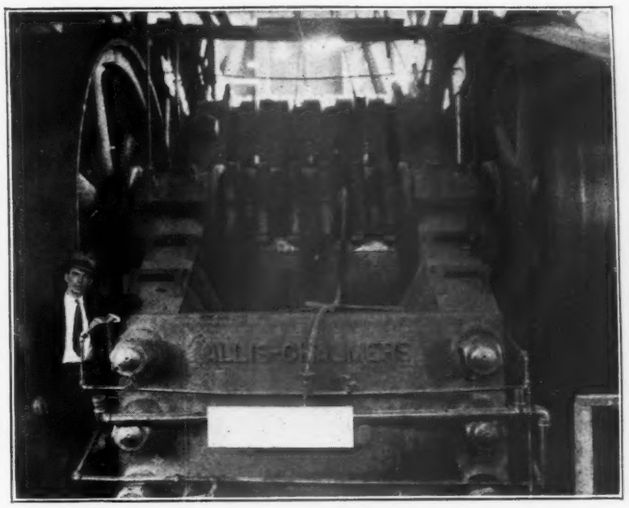
An automatic Weightometer made by the Conveying Weigher Company weighs every ton of finished product as it passes the plant laboratory. This conveyor discharges into a chute in the delivery house which feeds into barges in the loading slip. A blend is again obtained by keeping the barges constantly in motion under the loading chute.

The conveyors were furnished by the Stephens-Adamson Manufacturing Company and the Conveying Weigher Company, and Manhattan Rubber Company conveyor belting is used throughout. The primary crusher is driven by a 150-hp. Buckeye steam engine, and the remainder of the plant is driven through an arrangement of belts and pulleys by a 250-hp. engine of the same make. A Westinghouse 40-kw. generator driven by a Chandler-Taylor steam engine furnishes lights for the village as well as for the small tools in the machine shop. Water for the boilers and other purposes is pumped from the Nolin river by Cameron and Dean pumps driven by steam from plant boilers. Water is piped to all of the quarries.

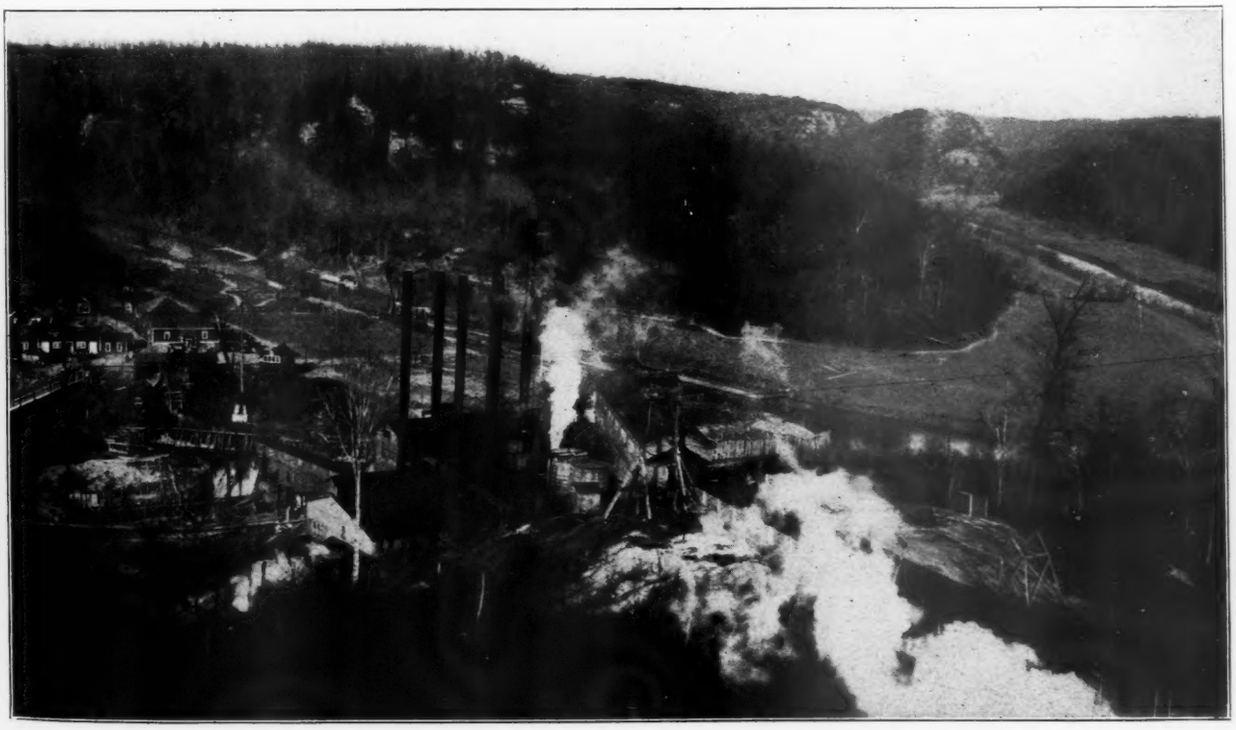
Shipment of Kyrock

There is no direct rail connection between Kyrock and outside sources due to the extremely rugged nature of the country. There is only one road leading from the property and this involves a ferry across the Green river. This road is very difficult to maintain and in wet weather becomes practically impassable. All shipments, therefore, are made by water to the nearest shipping points on railroads. Most of the product is hauled in barges a distance of 70 miles down the Nolin and Green rivers and up Barren river to Bowling Green, where it is shipped out over the Louisville and Nashville railroad. Some is also barged a distance of 80 miles down the Green river to Rockport and shipped out over the Illinois Central railroad.

The barges in which the finished product is hauled from the plant are 26 feet wide and 100 feet long with a capacity of 300 tons each. They are hauled four at a time by both Diesel and steam-



A View of the 60-in. by 48-in. Primary Crusher



Bird's-Eye View of Kyrock Plant from Primary Crusher Building. Barge Loading Slip Is Visible at Left

View of Belt Conveyor Carrying Kyrock from Primary Crusher to the Storage Bin

driven stern wheel tow-boats. Four of these boats and 30 barges are now in operation.

The Shipping Yards

The barges are unloaded at Bowling Green by a steel stiff-leg derrick with a 3-yd. clamshell bucket into a steel hopper. This discharges into cars which are hauled up a double incline, carried on a double aerial tramway of 300-ft. span and dumped onto a storage pile of 150,000-ton capacity. The storage pile is underlaid with standard railroad tracks which are exposed and used by trains of gondola cars as the material is loaded for shipment. An Erie steam shovel does the loading.

At Rockport the material is unloaded from the barges by a Bedford Iron Works derrick equipped with a Williams bucket and an American Hoist and Derrick Company hoist. The material is stockpiled and loaded in much the same manner as at Bowling Green.

All shipments are made direct to the consumer in carload lots as the company has no distributing branches. There are, however, sales engineers in every principal city. Kyrock is shipped to 35 states, as far west as Iowa, east to New York and north to Canada by rail, and south to South America by boat from the ports of New Orleans, Mobile and Pensacola.

Laboratories Controlling Bitumen Content

Four laboratories are maintained to insure absolute uniformity of the product. One of these is located at the quarries, one at Bowling Green, one at Rockport and the main laboratory is at the plant. The plant laboratory is equipped to make any tests desired and has two chemists as well as a number of assistants constantly checking the finished product. Sturtevant, E. H. Sargent and Brown Corporation laboratory crushers are used.

The efficiency of the system used to control the bitumen content is evidenced by the fact that in the past three years the general average of all tests of the finished product made in the laboratory has not varied more than 0.3 per cent. The average content last year was 7.13 per cent. The bitumen

Main Quarry View, Showing Crane Handling Skip-Box Loaded With Hand-Picked Fragments of Kyrock

content in the various deposits varies considerably but only the stone containing between 6 and 8 per cent is used commercially. The stone outside of these limits is used for railway ballast or hauled away as waste.

The Engineering Corps

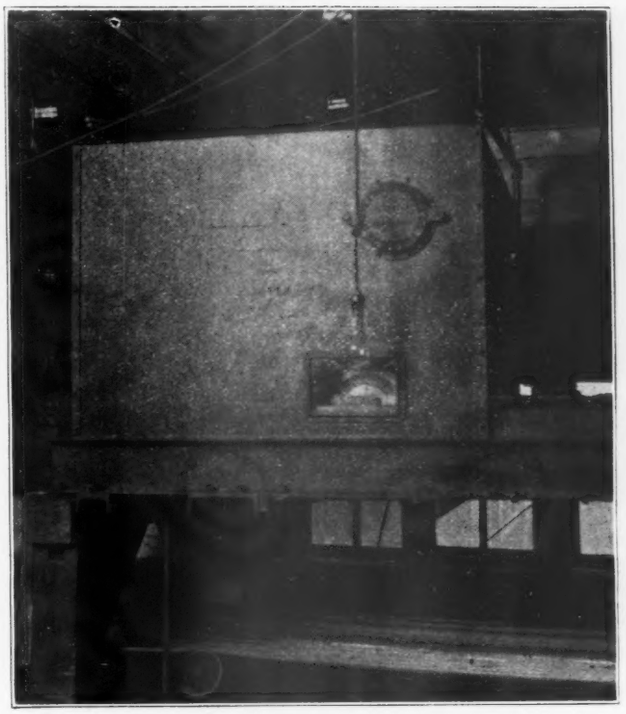
An engineering corps is maintained for property surveys and railroad location work. The engineers also lay out the entire property in 50-ft. squares for core drill tests. Every foot of core recovered is analyzed and tested and recorded to show the quality of the deposit for future reference. At present the drilling is from 6 to 8 years in advance of operations. Two Bravo diamond drills made by the Sullivan Machinery Company are kept busy on this work.

The Machine Shop and Power House

The blacksmith and machine shop at the plant contains a South Bend lathe, several acetylene welding outfits, a Sullivan drill sharpener and a complete outfit of blacksmith tools. The power house contains an Ingersoll-Rand Imperial Type 10 steam-driven air compressor, the 250-hp. Buckeye engine which operates the plant, the generating set which furnishes light, and a set of boilers rated at about 1,000-hp. A Bristol automatic recording pressure system is used for both air and steam.

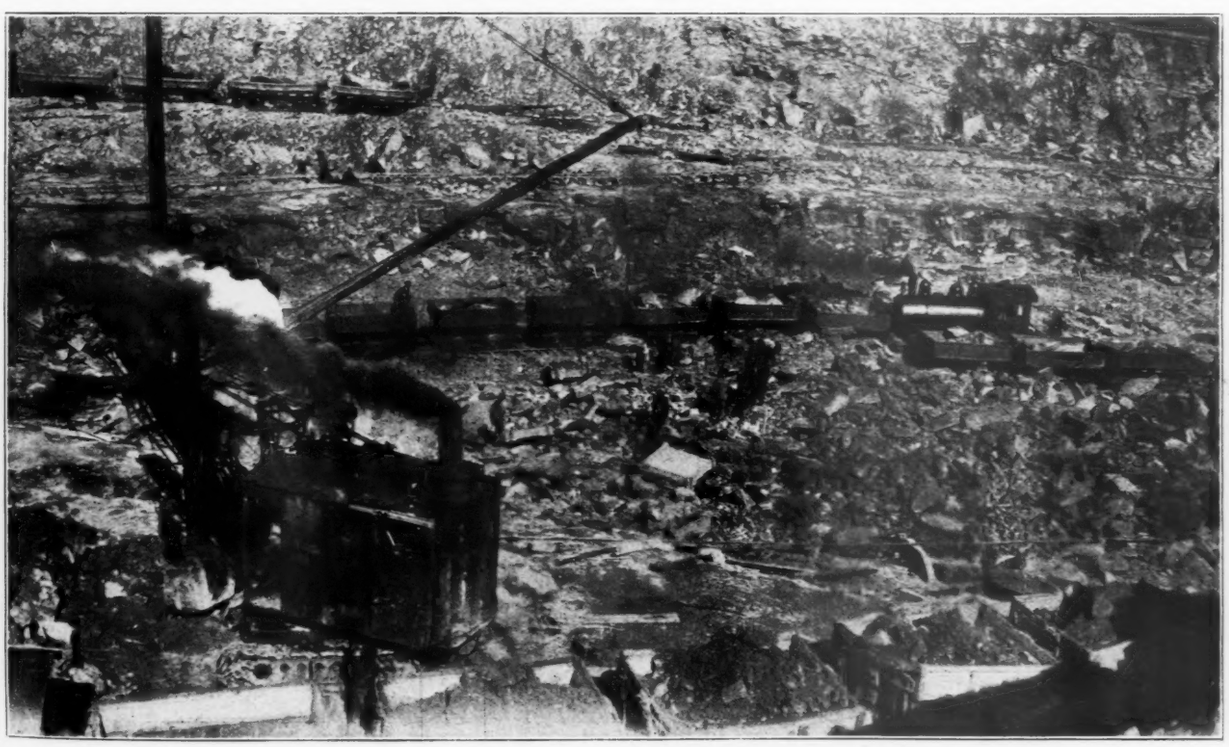
Coal and Supplies

Coal is brought in from mines along the Green river by empty barges on their return trips. The coal is unloaded by a derrick crane with a 2-yd. clamshell bucket into a wooden hopper on the opposite side of the canal from the plant. The hopper discharges into a bucket which is hauled up a cableway to the top of the hill above the plant. The coal is stored here and hauled to the various quarries in the same cars which haul the rock.



The Weightometer Which Automatically Weighs All Material as It Passes the Laboratory

A gasoline launch "Kyrock" is used for transportation and passenger purposes when the roads are impassable. A dredge boat and pile driving outfit are also maintained to keep the canal or



Typical Scene in the Sweeden Quarry. Steam Shovel and Guy Derrick Loading Kyrock Into Cars

Interior View of Blacksmith and Repair Shop. Drill Sharpener at Left

harbor open and to unload supplies, all of which come in by boat.

Safety and Fire Prevention

Every possible precaution is taken throughout the entire operations of the company to prevent accidents. The plant was entered in the National Safety competition this year and regular classes in safety and first aid are held. Workmen's compensation is carried for all employes and group insurance for those who desire it. A completely equipped field hospital is maintained with a doctor and trained nurse in constant attendance. That safety measures are enforced is evidenced by the

View of Plant from Across Loading Slip. Crane for Unloading Coal at Left, Barge Being Loaded With Kyrock in Center

View of Main Laboratory at Plant, Where Two Chemists and Several Assistants Check Every Ton of Finished Product

fact that no casualties have occurred in more than four years.

Every precaution is also taken to eliminate fire hazards. The plant and all main buildings are protected by a Grinnell dry pipe automatic sprinkler system. An Ajax chemical fire engine furnishes protection for the village. A 1,000 g.p.m. capacity Worthington pump at the canal is held in reserve

Derrick Unloading Kyrock from Barges to Stockpiles at Bowling Green on the Barren River. Tow-Boat With Other Barges Waiting to Be Unloaded

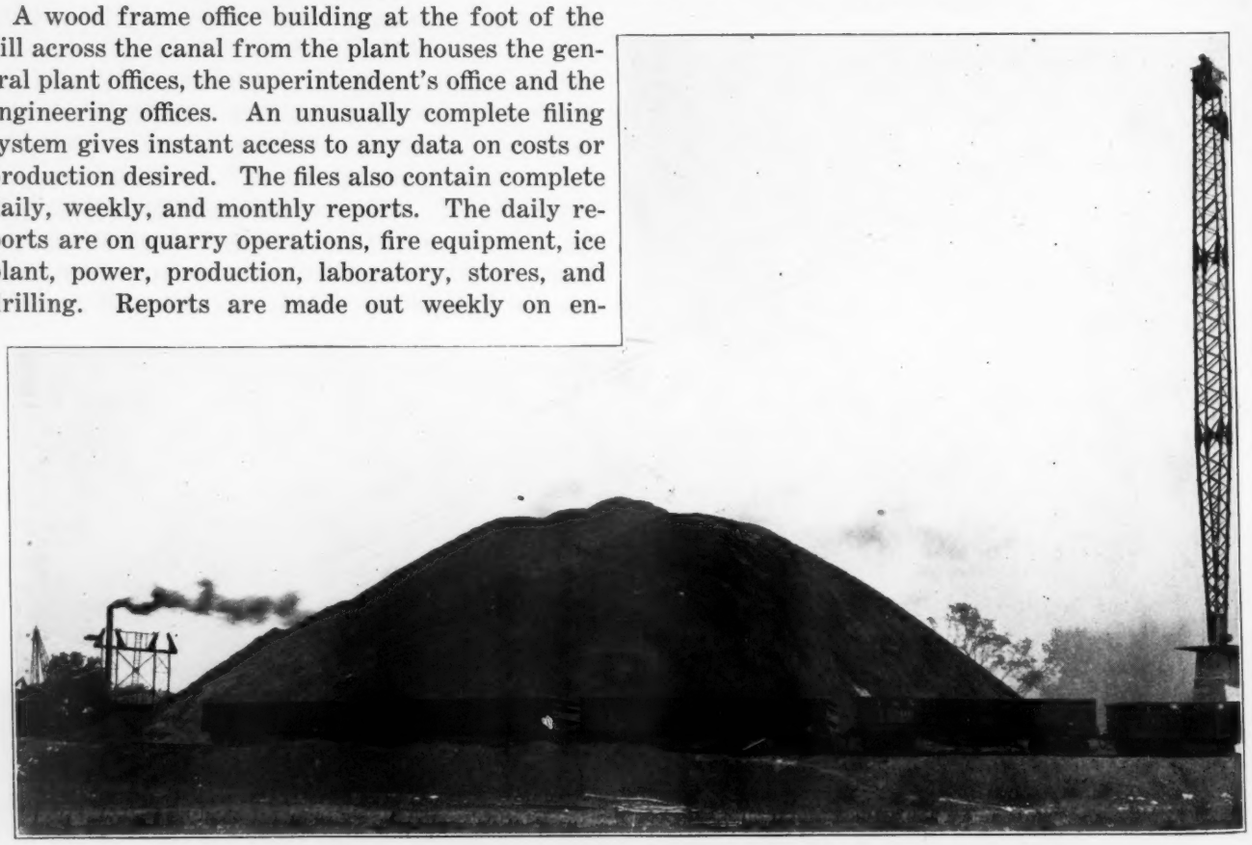
The Kyrock Combined Grade and High School at Which Attendance Is Compulsory. More Than 275 Pupils Are Enrolled and Six Teachers Are Employed

for any emergency. All of the property is patrolled by a force of ten night watchmen using clock stations made by the Chicago Watchman's Clock Company.

The Plant Office

A wood frame office building at the foot of the hill across the canal from the plant houses the general plant offices, the superintendent's office and the engineering offices. An unusually complete filing system gives instant access to any data on costs or production desired. The files also contain complete daily, weekly, and monthly reports. The daily reports are on quarry operations, fire equipment, ice plant, power, production, laboratory, stores, and drilling. Reports are made out weekly on engineering, medical, laboratory, supplies and progress. There are also monthly boiler inspection and stripping and quarry reports.

The office force, engineering crews and the employes in executive positions are of an un-



150,000-Ton Capacity Storage Pile at Bowling Green. Steam Shovel at Left Loading from Stockpile Into Car

usually high type, most of them being college graduates. All of the married men have their own homes and the single men stay in the Kyrock Hotel.

Employes' Living Conditions

About 500 men are employed the year round. They and their families live in company houses on company property. Each of these houses has its own lot and garden, steam heat, electric light and piped spring water. In the village of Kyrock proper there are over 200 of these houses, with many others scattered through the hills near the various quarries. The total population of the community is about 1,500. The company operates three commissaries at which almost anything desired can be purchased. These commissaries are not run for profit. A hotel is maintained for transients, such as traveling salesmen, and for single employes. There is also a barber shop. All water for the villages and quarries is purified by a Wallace and Tiernan chlorinator at the plant. Ice for the use of the employes is made in a Brunswick Refrigerating Company ice machine.

The spiritual requirements of the employes are satisfied by a non-sectarian church. This is also maintained by the company and the minister is on the regular payroll. There is also a grade school and high school with six teachers and more than 275 students. Motion pictures are shown twice weekly in the schoolhouse and there is a free circulating library for those with literary inclinations. Tennis and basketball courts are maintained for those athletically inclined. The employes and the school each have their own baseball and basketball teams which have made a fine record in competition with teams from neighboring communities. The company baseball team has beaten some of the best teams in Kentucky and neighboring states.

The employes are happy and contented and are unusually peaceable for Kentucky mountaineers. This is largely due to the strict regulations laid down by the company and enforced by the company police force. There is also a sanitary commission to enforce cleanliness among the employes. School is compulsory for all children under 16 and no one under 18 is allowed to work.

Personnel

W. H. Tarvin is president. Rodman Wiley, former chief engineer of the state highway commission of Kentucky is vice president in charge of sales, Arnold A. Hermes is secretary and treasurer, H. St. G. T. Carmichael is vice president in charge of production and maintains his office at the plant. H. L. Burch is traffic manager and purchasing agent. W. A. Brownfield, chief engineer, and his wife were drowned on the Vestris while on a trip to South America to inspect Kyrock recently laid. His successor has not yet been appointed.

National Lime Association Announces Series of Meetings

Norman G. Hough, secretary of the National Lime Association, announces that a date has been set for the annual meeting, which has been deferred several weeks awaiting a decision by the Federal Trade Commission as to when it could meet with the association for a trade practice conference. The Trade Commission has fixed its date, and Mr. Hough accordingly sets the following dates for a series of Lime Association meetings:

Norman G. Hough
Manager National Lime Association

Wednesday, June 26. Open meeting of the entire lime industry to consider a Code of Practices that will be submitted to the Federal Trade Commission.

Thursday, June 27. Trade practice conference, with the Federal Trade Commission.

Friday, June 28. Eleventh annual meeting of the National Lime Association.

These meetings will be held at the Mayflower Hotel, Washington, District of Columbia.

California Now Produces Red Travertine

Shipments of travertine have begun from the extensive deposits operated near Bridgeport, California, by the California Red Travertine Company. The material is used extensively in interior decorating, and for table-tops, lamp-bases, and other articles.

Budgeting Advertising Expense

By J. J. BERLINER

A GREAT many of the concerns which advertise have no advertising department within their organizations, but place all their advertising through a professional agency. Where an advertising department is set up to handle the advertising function—its relation to the other departments, such as sales and production—varies widely. In some instances the advertising manager reports to the sales manager, thus tending to assure a close coordination between advertising and sales. In others the advertising department is quite distinct from the sales department, and coordination is effected through conferences.

Advertising is usually a form of selling effort. Its purpose is to stimulate sales. That being the case, it should be so planned as to make possible the volume of sales which is best suited to the needs of all departments of a business. This is true whether the responsibility for advertising rests with an advertising manager or an advertising agency. Methods used will necessarily vary as a result of differences in organization and in problems.

There has been a great deal of discussion concerning methods of calculating the amount of the advertising appropriation. In most instances these discussions have not gone beyond the problem of determining the total appropriation. We are not here directly concerned with the question as to whether the appropriation should be based upon the unit of product, or anticipated sales, or post sales, or net profits. The major problem is not only to find a method of estimating the total appropriation but also a means by which we may anticipate the effect of the use of that appropriation upon the business as a whole. Detailed planning is obviously necessary to accomplish this second objective. A lump-sum appropriation is not adequate.

The ideal advertising plan or budget should show:

1. The total cost of advertising during the coming year.
2. The cost of advertising each group or group of products.

YEAR 1928 — ADVERTISING BUDGET SUMMARY

DIRECT EXPENSE

		Estimated 1928												Misc.	Total
		Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.		
A															
B															
C															
D															
E															
F															
TOTAL															

INDIRECT EXPENSE

Salaries															
Heat and Light															
Tel. and Tel.															
Repairs															
Supplies															
Misc.															
TOTAL															

Fig. 1. Advertising Budget Summary

3. The amount to be expended in each medium for each product, or group of products.

A budget constructed in the above manner has numerous advantages over the familiar "lump-sum" appropriation.

1. It makes possible a comparison between the estimated costs of selling individual products or groups of products and the total anticipated income resulting from sales of these products.

2. It compels the laying out of a complete advertising plan in advance and therefore assures a more effective and better coordinated program than would otherwise be possible. It assures the directing of selling effort into the most profitable channels.

3. It results in a far better coordination between advertising and the activities of other departments than could otherwise be effected. Advertising plans are of direct or indirect interest to every major department of a business despite a tendency, often found, to view advertising as an isolated activity of a highly technical nature.

4. By setting up detailed expense standards, and enforcing those standards, a close control over advertising expense is assured.

With the above considerations in mind we may proceed to develop, by assuming a typical case, a possible method of planning and controlling advertising expenditures.

Let us assume that the concern under consideration has its own advertising department and does not assign its advertising to a professional agency. Its advertising consists of three types:

(1) Periodicals;
(2) Mailing pieces;
(3) Exhibits at conventions and fairs.

It is assumed that its products are six in number and that each product is advertised separately. The advertising organization consists of an advertising manager and his staff of clerks, copywriters, artists, etc. In this case we will have two classes of expenditure: (1) Direct costs, or expenses chargeable directly to individual products, such as trade paper advertisement of product A; (2) Indirect costs or expenses not chargeable directly to individual products, such as the salary of the advertising manager.

The budget period is preferably a year in length and the advertising manager should begin work on the budget at least several weeks before the beginning of the period. Conferences with other executives will, of course, be necessary in order to ascertain the plans of other departments. After preliminary figures have been determined, they are collected in summary on a report similar to that shown in Fig. 1. This report shows the estimated expenses by months, direct expenses being classified by products and indirect expenses by types. The actual expenses for the preceding year are shown for purpose of comparison. This form is usually suitable for submission to the budget committee, president, or board of directors.

It is not sufficient, however, to prepare only a summary estimate of the expenses of advertising each product. The budget summary should be supplemented by detailed estimates which account for each item of expense to be incurred in advertising each product. It is in this detailed planning that the budgeting of advertising expense finds its greatest justification.

One type of form useful in presenting a detailed

ADVERTISING BUDGET FOR PRODUCT A—YEAR 1928

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Periodicals												
X												
Y												
Z												
Cuts												
Photographs												
Mailing Pieces												
Booklet No. 14												
Folder No. 26												
Circular No. 17												
Folder No. 29												
Exhibits												
Reserve												
Total												

Fig. 2. Estimate of Advertising a Single Product

ADVERTISING BUDGET REPORT

Product	Estimated for Year	Jan.		Feb.		Mar.	
		Estimated	Actual	Estimated	Actual	Estimated	Actual
A							
B							
C							
D							
E							
F							

Fig. 3. Advertising Budget Report Card

estimate of the expenses to be incurred in advertising a single product is shown in Figure 2. If a similar estimate is made for each product or group of products the effect will be to show not only the total anticipated costs of advertising each product or group of products, but also the detailed plans of the entire campaign. The advertising manager has a picture of the activities of the year before the year has begun, and a scientific analysis of the probable effect of the program can therefore be made. It will be noted that a reserve is set aside for each product. This may or may not be feasible, but is usually advisable because of the difficulty of preparing absolutely accurate estimates. Needless to say, the amount of the reserve should be small as compared with the specific appropriations.

After the advertising estimate has been approved it is the responsibility of the advertising manager to see that it is not exceeded. A system of records and reports is needed whereby comparisons may be promptly and at frequent intervals between actual and estimated expenditures. The regular accounts of a business will rarely give a sufficiently detailed classification of expenditures to provide adequate control. For this reason it is usually desirable to provide in some manner for a supplementary tabulation of all charges to advertising expense. This may be handled by a clerk in the advertising department, if no objection is held to decentralized records. Postings are made by this clerk to a record which provides a classification of expenditures conforming to the classifications in the detailed estimates. At the end of each month, totals are taken and reports submitted to the proper executives.

The original estimates, when approved, are transferred to cards similar to that shown in Figure 3. These cards are then filed by the advertising manager for his reference. As actual figures become available, they are posted to the cards.

The original plan must be held subject to change in the event of unforeseen developments of a serious nature. The advertising budget should be flexible, and the mechanism for making changes in the appropriation during the budget period should be set up before the system is installed. Changes should be permitted only upon the approval of a responsible agency.

The cost of budgeting is often raised as an objection to the installation of a system of budget control. One case which is quite typical may be cited in reply to this objection. In this case the cost of operating the advertising budget is approximately one-third of one per cent of the total advertising appropriation.

The Canadian Department of Mines has given special investigation to the clays of Saskatchewan which holds resources of many earths.

Eliminate Antique Roads

By E. E. Duffy

Antiquated highways, still quite common, have no honored place in the modern transportation scheme. Commercial usage of the highway is being made to an extent that almost bewilders the imagination.

Many railroad companies now operate bus lines. Motor coaches and trucks in some instances have replaced branch line steam transportation. The latest railroad to enter the motor transportation field is the Burlington which is now maintaining schedules between several principal cities of Nebraska. A significant feature of this service is that it parallels railroad lines.

A fairly clear picture of the importance of the highway may be obtained from the railroad passenger figures of 1928 which show the lowest volume in 20 years. One of the leading railroads attributes this falling off in business to a number of causes but the chief is that of increased use of the passenger car and the motor bus.

Consequently highways are being punished today in a measure not anticipated a dozen years ago. Unfortunately much of this traffic is forced over roads as old fashioned as celluloid collars. Automobiles are not designed to jiggle over washboards, shell holes, or surfaces that wear out nerves as well as tires and other automotive equipment.

In buying new highways, a community can best serve itself by ordering roads thoroughly in keeping with its current traffic needs, and of even greater importance, its potential needs. There is no way of definitely measuring tomorrow's requirements, but it can be truthfully stated that not a single community in this country has more well paved roads than it has good use for.

This matter of road building has its peculiarities. The criticism has been levied that those making commercial use of the highways should be heavily taxed for the construction and upkeep of the roads. Examination of state and local records reveals that commercial car owners are indeed paying their share, and sometimes perhaps more than their share, of the road expense. Commercial cars are nothing more than public servants, yet all too frequently heavy vehicles are unduly blamed for the excessive wear and tear of the public highway. Inferior streets naturally deteriorate under heavy traffic and clearly the community must build substantial pavements for this commercial travel.

Roads should be built that are wide and smooth, continuous and direct. By so doing transportation is improved and its cost is lowered. That means that the public is benefitting itself.

The local chamber of commerce is sponsoring the development of several limestone quarries to supply road-building material for Cairo, Georgia.

Metallurgical Limestone: Problems in Production and Utilization

By OLIVER BOWLES*

ENORMOUS quantities of limestone are employed in modern metallurgy, particularly for fluxing. Approximately 24,000,000 tons were so used in the United States in 1926, chiefly in the smelting of iron ores in the blast furnace. Smaller amounts are used in basic open-hearth steel manufacture and in smelting lead, copper, and other nonferrous ores. As limestone enters largely into metallurgical operations, an intimate knowledge not only of its utilization but also of its occurrence and qualities, and of the methods of mining and preparing it, is essential to the highest development of metallurgical practice.

Most limestone producers have little knowledge of the way in which their stone is used in metallurgy. The maximum content of silica, alumina, sulphur, and possibly magnesium and the minimum content of calcium carbonate may be arbitrarily fixed for the guidance of the producer; but aside from these requirements little information is available to producers on how their stone is used, the office it performs in smelting, or the effects of impurities. More complete knowledge of utilization would enable limestone operators to solve their production problems more intelligently.

On the other hand, the metallurgist's knowledge of conditions governing limestone production is usually limited. The literature of metallurgy is notably lacking in comprehensive discussions of fluxing or furnace stone. Approximately 900 pounds of limestone is used for every long ton of pig iron produced in the blast furnace but this important constituent of the charge receives little attention compared with the intensive study of ores and fuels, the other important constituents of the charge.

The writer has made a wide review of metallurgical literature in an effort to elucidate some of the doubtful points and has had the disappointing experience of finding not more than a paragraph or two on metallurgical stone for each two or three thousand pages of literature reviewed. Furthermore, the limited information supplied is in some instances contradictory and even absurd. For example, a correspondent in a reputable metallurgical magazine classifies magnesia and silica together as impurities in flux "that must be melted and run off as slag."

As stated above, the metallurgist's knowledge of conditions governing limestone production is usually limited. Wider information on the origin and occurrence of limestone, on quarrying processes, and on methods of separation from impurities would undoubtedly be an advantage to the furnace operator. A lack of appreciation of modern production methods has in some instances led to decisions that worked a hardship on the fluxing-stone producer without any advantage to the metallurgist. For instance, there is a deep-seated prejudice against limestone fines because in open-pit quarrying the sand and clay impurities are concentrated in the fines. Some stone producers who obtain their stone by underground methods have found great difficulty in convincing furnace operators that their fines are as pure as lump stone. With an intimate knowledge of limestone mining this would easily be understood.

The purpose of this report is to cover as completely as possible our present knowledge of the utilization of metallurgical stone and the problems connected with its quarrying or mining and preparation. With this object in view, it is believed that a clear coordination of all the factors involved may be worked out, and that mutual advantages will ensue to both producers and consumers.

A part of this paper dealing with utilization problems was presented at the February, 1928, meeting of the American Institute of Mining and Metallurgical Engineers, and the discussion thereon provided additional data on some of the more complex questions.

Origin and Character of Limestone

The term "limestone" in its narrow sense is applied to rocks consisting essentially of calcite (calcium carbonate). Commercially, it includes rocks consisting essentially of the double carbonates of lime and magnesia ($CaCO_3.MgCO_3$). In this report the term "limestone" includes calcite, dolomite, and all intermediate forms; therefore, furnace lining, for which dolomite is widely used, comes within the scope of the discussion.

Calcium carbonate, although practically insoluble in pure water, is soluble to some extent in water containing other elements and compounds, notably carbon dioxide. Thus, rivers, lakes, and oceans contain small percentages of calcium carbonate in solution. Many marine organisms, such as crinoids, corals, mollusks, and foraminifera, can abstract calcium carbonate from water to form their shells. As unnumbered multitudes of these animals live and die in succeeding generations, the accumulation of shells may form beds many hun-

* Excerpts from Bulletin 299, Bureau of Mines. The work on the manuscript was completed in September, 1928.

dreds of feet in thickness. In addition to this shell accumulation calcium carbonate may be precipitated chemically from sea water. Such mechanical and chemical precipitates when consolidated may form beds of limestone of great thickness. Many of the limestones still contain fossil shells indicating the original source of the material, but in many others all trace of organic origin has been destroyed, the shells having been ground together and worked over by water before their final consolidation. In many parts of the world earth movement has elevated these beds above the surface of the water and thus made them available for commercial use.

Magnesium carbonate is often present in limestones. When the amount present approaches 45 per cent of the total mass, the term "dolomite" is applied to the rock. Where smaller percentages of magnesium are present, the rock may be termed "dolomitic limestone" or "magnesian limestone." Most dolomites have been formed through the introduction of magnesium into the limestone due to the circulation of water after original deposition.

Varieties of Limestone

Special names are applied to limestones that differ in origin, texture, or composition from the ordinary type. Marble is formed from limestone by some process of recrystallization. Marl is a term applied to a loose earthy form of lime carbonate usually formed in lake basins. Calcareous tufa and travertine are more or less compact limestones deposited from solution. They are usually found around springs or along the courses of resulting streams. Oolitic limestone, so called because of its resemblance to fish roe, is made up of small rounded grains of lime carbonate having a concentrically laminated structure. The famous limestones of Bedford, Ind., are of this type. Chalk is composed of finely ground shells loosely cemented together. A siliceous or cherty limestone is one that contains considerable silica, an argillaceous limestone is one containing clay or shale, a ferruginous limestone is one containing a small percentage of iron which usually gives it a reddish or yellowish color, and a carbonaceous or bituminous limestone is one containing carbonaceous matter. For metallurgical uses, only small percentages of impurities are permissible.

Physical Characteristics of Limestone

Limestones vary greatly in such physical properties as hardness, color, weight, porosity and texture. In color limestones vary from pure white to black, the colored effects being brought about chiefly by the presence of impurities. In texture limestones may be amorphous, semicrystalline, or crystalline; in compactness they vary from the loosely consolidated marls through the chalks to the compact normal limestones and the harder marbles. Porous limestone may weigh as little as 110 pounds per cubic foot, whereas the more compact varieties may weigh 150 to 185 pounds. The dense, highly consolidated forms are preferred for furnace use.

Distribution and Transportation of Limestone

It is fortunate that limestone deposits are widely distributed in the United States. Millions of tons are employed for metallurgy, lime and cement manufacture, crushed stone, agriculture, and many other uses. As stone commands a low price, transportation charges may constitute a large share of the final costs; therefore, it is a great advantage to any industry using limestone to find a source of supply near the point of utilization. Every state has deposits. Through inadequacy of supply, lack of availability, or lack of the desired physical or chemical qualities in the deposits nearest at hand, large quantities of limestone or its products enter interstate commerce. As will be pointed out later in greater detail, the transportation charge may have a very direct bearing on the quality of stone employed in metallurgy.

Naturally, metallurgical stone has been developed most widely near the centers of the great smelting industries. Thus, the Ohio and Pennsylvania quarries supply enormous quantities of limestone for the smelting district lying in and about Cleveland, Ashtabula, Youngstown, and Pittsburgh; and Alabama quarries supply flux for the Birmingham iron industry. However, there is a tendency on the part of large producers, particularly smelting companies that operate their own flux quarries, to distribute their activities over a wide territory, so that in case of difficulties in labor supply or in other restraints of local character adequate requirements may be obtained from other sources where the limiting conditions do not exist. For example, quarries near Martinsburg, W. Va., supply large quantities of flux to the western Pennsylvania furnaces.

The growth of great iron-smelting industries at lake ports, such as Chicago, Cleveland, and Buffalo, is due in part to cheap water transportation of the ores from the Lake Superior district and in part to the same ease in water transportation of fluxing stone. The accessibility of the iron ranges to the Great Lakes has its counterpart in a lesser degree in the development of a great limestone industry at Calcite, Mich., where the largest quarries in the world produce many thousands of tons of stone every day. A map showing the distribution of stone from this Michigan port resembles very closely the map showing the course of travel of the iron ores, for the stone is carried to many of the same ports to be used

with the ores in the same furnaces. The possibility of easy and cheap water transportation of this pure, high-calcium stone has no doubt encouraged the growth of smelting industries at lake ports. It is noteworthy that the low cost of water haulage permits transportation for many hundreds of miles, while rail haulage for similar distances would be economically impossible.

Some inland smelting districts are not well supplied with suitable stone near at hand and are therefore handicapped with heavy transportation charges or are obliged to use stone of inferior quality.

Following is a list of the chief flux-producing states, with the tonnage based on 1926 figures, as compiled by the bureau:

State	Short tons	State	Short tons
Pennsylvania	8,694,870	Illinois	673,340
Michigan	6,627,090	Colorado	460,420
Ohio	2,851,980	All other States	1,478,770
West Virginia	2,155,410		
Alabama	908,820	Total	23,849,700

Prospecting

The market for fluxing stone is extensive, and usually a large tonnage is demanded from quarries. Any deposit in which it is proposed to quarry should have an ample supply of stone for at least twenty years of operation. Three important features that the metallurgical limestone prospector should have in view are, (1) chemical composition, (2) extent, and (3) workability. Prospecting may be simple or complex, depending on the nature of the deposit. Flatlying beds of uniform composition present an easy problem. On the other hand, where the beds are greatly tilted or folded, as in the Appalachian belt, and where the or on a surface uncovered by test pits or by trenching is a preliminary step in prospecting. If the deposit appears to be extensive, and if the chemical composition is satisfactory, this should be followed by prospect drilling. The churn or well drill is composition varies greatly, prospecting may be exceedingly difficult. Surface sampling on outcrops widely used. Samples of drill cuttings should be taken at regular intervals, such as every five feet, and an exact record kept of the drill hole and depth at which each sample is taken. The distance between samples should be governed by the uniformity of the rock. Obviously, samples should be taken at close intervals where analyses show lack of uniformity and liability to pronounced change in chemical composition from point to point.

The position and spacing of the holes is governed by the nature of the rock. In flat-lying beds of uniform thickness and fairly constant composition, the holes may be spaced at wide intervals, 100, 500 or 1,000 feet. Where the beds are folded or tilted, or where changes in composition occur within short distances in the same or successive beds, the holes should be more closely spaced. No definite rules can be given either for the position or arrangement of the geological map is of great assistance in prospecting tilted and folded deposits. From a map constructed after a careful study of exposures one can determine the position, thickness, and slope of beds with a fair degree of accuracy. Topographic maps, geologic maps, and structure sections enable the prospector to lay out the positions of prospect drill holes.

As a rule, a given limestone bed is fairly constant in composition. The greatest variations occur in passing from one bed to another, and the most valuable information regarding a deposit is therefore gained from a drill hole that intersects the beds. The drill holes should be projected approximately at right angles to the bedding. The core drill has decided advantages over the churn drill, as it may be used for drilling holes at any angle, even in a horizontal position if so desired, while churn drill holes except in rare instances are vertical. Core drilling is much more costly than churn drilling, but it has other advantages besides the possibility of drilling inclined holes. A study of the cores enables one to learn the physical character of the rock, and if the cores are carefully oriented the dip of the beds may also be determined approximately. The cores should be split, one half being carefully preserved for reference and the other half being used to provide samples for physical study and for chemical analysis.

Prospect drilling also supplies information on the nature and depth of overburden that will be encountered when the deposit is opened up and during successive stages of development. If impure beds of solid rock overlie the limestone and if such beds can not be adequately studied in outcrop, core drill holes should be made to provide samples for physical study, for it is important to determine the probable strength and endurance of the rock as a hanging wall or as a roof for underground mining.

If prospecting reveals the presence of an extensive deposit of limestone of satisfactory composition in such a position that it may be worked with reasonable ease, the next step is to figure out the best plan of development.

Plan of Development

It is assumed that the factors of market, freight rates, transportation facilities, and labor conditions have been given adequate study and have been found satisfactory enough to warrant operation. Following preliminary investigations, the direct problem of quarry development must be considered. Usually in the quarrying of metallurgical limestone the margin of profit is not high, and it is therefore desirable to work out the most economical method of operation. Many factors

must be considered in working out the best plan of development.

The most simple types of operations are carried on in flat-lying beds. Open-pit development is the most desirable and should be maintained if the overburden is not excessive. As the result of a cost study of many mines and quarries, J. R. Thoenen* estimated that under average conditions underground mining is more profitable than open-pit work if the cost of stripping exceeds 30 cents per ton of stone quarried. He emphasizes the fact that this figure is to serve merely as a general guide, for many circumstances may arise to change the figure or, for reasons aside from the stripping charge, to influence a decision either for or against mining.

Quarries are of two types, the shelf and the pit. The hillside or shelf quarry is the more desirable, as rock transportation may be conducted on a level floor or on a moderate incline. The pit quarry requires hoisting by overhead cableway or some form of derrick or by cable haulage on inclined tracks. Occasionally rock is taken from pits of considerable depth by locomotive haulage using a system of back switching, but there are serious obections to this method. The shelf quarry is the most common, although numerous well-conducted pit quarries are operated successfully. With adequate equipment, the hoisting or cable haulage charge is not high.

Stripping

Stripping is an important operation at most open-pit quarries. In flat-lying beds of only moderate thickness the removal of a large tonnage of rock demands wide lateral development. Therefore, if a heavy overburden is present, the stripping charge may constitute one of the heaviest cost items. Under such circumstances, careful study must be given to the cheapest method of handling overburden, the best type of equipment to use, and the wisest choice of a location for waste disposal, so that future operations will not be impeded. With dipping beds the depth of overburden may increase rapidly as the face is advanced. If development in the direction of the strike or outcrop is restricted, the operator may face the necessity of underground operation some time in the future, and he should plan accordingly. When horizontal beds of good stone are 100 feet or more in thickness, deep quarrying may be used to reduce the stripping charge per ton of stone quarried.

With steeply inclined or folded beds the plan of development may be more complex. If the beds approach a vertical position and are of limited thickness, deep open-pit quarrying may be followed, the face being advanced in the direction of the strike. If the thickness of steeply inclined serviceable beds approaches several hundred feet, the face may be advanced either in the strike direction or at right angles to it. However, a more uniform product is obtained when the face is advanced in the strike direction.

The greatest disadvantage of sinking open pits in narrow, steeply inclined beds is that the hanging wall must be removed. The hanging wall of inferior rock must for safety be shot down approximately to a vertical face. It is evident that the mass of waste rock to be thus removed increases greatly with increasing depth of the pit, and the expense of moving so much waste material soon becomes prohibitive. In such deposits, when the limits of lateral expansion at moderate depth have been reached, underground mining becomes imperative. Such a contingency must be kept in view in planning the development of quarries in narrow, steeply tilted beds. If the beds are so thick that a vertical hanging wall may be maintained without shooting down inferior rock the problem is greatly simplified.

Pitching Formations

A similar problem is present in moderately tilted beds where the depth of overburden of either rock or soil increases greatly as the face is advanced in the direction of dip. Many open-pit quarries in dipping beds have reached the limit of profitable stripping and are now tunneled.

In planning the development of a quarry it is evident, therefore, that the operator should determine the most favorable position for an opening, the height of the face, the direction in which the face should be advanced, the depth and nature of overburden, the most favorable method and approximate cost of overburden removal, the extent and position of a suitable waste disposal area, and the method of rock loading and transportation. While such plans for quarry development are subjects of first importance to the prospective operator, future planning should not be restricted to those preparing to open up new deposits. Conditions are constantly changing even in quarries that have long been in operation. Quarrymen should look ahead and picture as clearly as possible the conditions that will prevail five or ten years hence. This will enable them to plan intelligently extensions of present workings or to modify methods of operation to conform with changing conditions. A careful study of all conditions, in the light of modern practice, and a close estimate of the cost of individual operations may enable a quarry owner to change any existing unfavorable methods of development and to place his industry on a more efficient and profitable working basis.

* Underground Limestone Mining: Bulletin 262, Bureau of Mines, 1927, page 10.

Dolomite Occurs in Two Natural Forms with Unlike Characteristics

By DR. A. KRIEGER*

DOLOMITE is a compound of calcium- and magnesium-carbonate. It is found in nature widely distributed and in more or less pure state. The normal dolomite contains both ingredients in molecular proportion. Nevertheless, there is also dolomitic limestone, which is used for industrial purposes and which contains an excess of lime as well as a high content of impurities such as alumina, iron-oxide and silica.

In addition to its uses in the preparation of mortar and cement, dolomite is used for the lining of furnaces in the production of iron and steel, due to its refractory properties which are much greater than those of clay or quartz, as well as to its basic character. When used for this purpose, the dolomite is first burnt at a sintering temperature and then briquetted with tar. It is employed in this form for constructing Bessemer linings and the like, as well as for the hearths of reverberatories. The dolomite may be used simultaneously with tar instead of being mixed previously with it in such constructions.

Magnesite stone is claimed to be better for these purposes but it is much more costly. The pure variety of dolomite is unsuitable for sintering purposes because a small amount of flux must be present. If not present, it must be added to the dolomite in order for it to sinter properly.

The use of dolomite in the preparation of cements and mortars forms a highly important market for this material. There are many ways in which it is thus employed. The compound CaO.MgO in the completely burnt state and in amorphus condition acts just like fat lime. It will slake easily to form a mass which can be spread out readily. If the dolomite has not been dead-burnt at too high a temperature, the magnesia will absorb the water from the mortar mixture and gradually form the crystalline hydrate. The result is that the mass is turned to stone. Furthermore, the presence of small amounts of silicate structures also helps in the formation of the stone-like structure.

The amount of water that must be added to the dolomite mortar is less than that employed with pure lime mortars for the reason that during the commencement of the setting process, magnesia combines with only little water but, as the hardening process progresses, the water which is set free during the action of carbon-dioxide on lime, is absorbed. It must be assumed that the suitability of dolomite mortar for plastering, particularly for interior work, is based on this after-hardening.

* Translation from Tonindustrie Zeitung, 1929, p. 413.

Dolomite Mortars

It is not remarkable that the consumption of dolomite should be increasing, for these characteristics of dolomite mortar are very favorable. However, the application of dolomite to this purpose would be greater than it is now, were it not for certain reasons which have stood in the way. In the first place, there is a considerable difference between the crystalline dolomite and its amorphous modification. The amorphous form deserves preference but unfortunately it is seldom found in the pure state. The crystalline form is much more plentiful. This variety of dolomite must be burnt at a much higher temperature than the amorphous dolomite with the result that the slaking of the product is more difficult. This necessitates that the slaked materials must generally be ground.

Furthermore, the weight per unit volume of the raw crystalline stone is greater, which introduces the necessity of burning the product at a higher temperature—just as limestone of higher density requires a higher burning temperature. On the other hand, the color of the burnt, amorphous dolomite is mostly dark so that it cannot enjoy general application. The purity of the color plays an outstanding role in the use of the product for the preparation of white and colored plasters. The dark color of the burnt product is caused by the presence of organic compounds in the original raw material, and these are decomposed with the production of carbon during the burning process.

Burnt dolomite can be used without admixture of other cement-forming ingredients for the same purposes as fat lime and hydraulic lime. It is unsurpassed as a raw material in making plasters for it possesses an advantage over fat lime in allowing a greater proportion of foreign materials to be added tc it, and over hydraulic mortar in that its color is frequently better than the latter. Burnt dolomite is worked up into fine plasters and when used for this purpose it is found to possess decided advantages.

An additional field for burnt dolomite is its use in the preparation of coating compositions such as paints. The pure white, amorphous variety of dolomite is particularly suited for this purpose. The coating cannot be wiped off, so that the addition of certain substances, such as alum (necessary in the preparation of lime coating compositions) is not required. Cracks do not form when rich mixtures are employed. Such a dolomite coating becomes hard within a few hours, and a luster is formed on the surface which resembles that obtained with oil

paints and the like. On the other hand, the surface does not possess the disadvantageous character of the oil coating or film, namely, impenetrability to air. The coating or film will adhere well to cement plaster and to natural stone. This is not true with the ordinary lime coating or film for, as is well-known, the latter can be quickly washed away by rain. The quality of the fine plaster or coating compositions depends essentially on the addition of magnesium salts.

Dolomite in Cement Mixtures

The presence of dolomite, or rather magnesia, in raw cement mixtures is feared. According to the investigations of K. Balthasar (see Tonindustrie Zeitung, 1925, page 277), and others, there is a possibility of preparing cement mixtures with dolomitic rock, when only the lime and not the magnesia content is taken into consideration in determining the hydraulic modulus. Although a cement of similar quality can be produced in this manner, dolomitic rock is used for the manufacture of cement only in those cases where it cannot be avoided. On the other hand, the simultaneous working up of burnt dolomite and cement mortar cannot be objected to on any grounds.

It has been shown by the investigations made by Dyckerhoff (Chemical Technology of Mortar Raw Materials, Feichtinger) that there is an improvement in the resistance of the cement to compression and tension as well as an increase in the adhesive action of the cement when fat lime is added to lean cement mixtures. Furthermore, the mixture is more pliable and is less inclined to the formation of fissures. According to the patent of Erdmenger, the same purpose is served by the addition of magnesia, in the finest possible state of division and which has been burnt at low temperatures. Magnesia is, however, too dear for this purpose, and hence dolomite is advantageously used in its place. Dolomite absorbs less water than fat lime, so its hardening is better and quicker.

The quantity of the added material may be greater in such mixtures. Cement mortars which are made with the addition of dolomite are impenetrable to water. This is the reason why such mixtures are preferred for under-water construction. Certain experiments showed that the completely-burnt and the half-burnt dolomite (from which only the carbon-dioxide combined with the magnesia has been driven out) possess the same properties. Under these conditions the dolomites are useful for admixture with concrete to make it more dense.

Light-weight Concretes

The author carried out certain tests to determine the strength of the so-called light concrete which was made with the addition of peat or wood sawdust in place of the mineral fillers. Samples which were prepared from this light concrete were subjected to the action of weathering. The observations showed that mixtures of cement and sawdust become unsightly and lose considerable of their strength, while mixtures of like nature made with dolomite are affected to a much less degree. It was shown also that these concrete samples have a lower weight per unit cubic volume, which may be as low as 0.59. The fact that materials can be used under such conditions for many different purposes is self-evident. Such applications as insulation and the like are indicated. The cumbersome and difficult impregnation of the sawdust before its use for mixing purposes is unnecessary when dolomite is employed in the preparation of light concrete. This simplifies, to a great extent, the working conditions under which the concrete is prepared.

Up to this point the completely-burnt dolomite has been considered principally. The existence of a half-burnt dolomite, from which the carbon-dioxide combined with the magnesia but not that combined with the lime, had been removed and which has the formula $MgO.CaCO_3$, was mentioned in writings at times in the past. It is also discussed by Schoch, Hirsch, and Nitzsche in their book entitled, Mortar Binders, fourth edition, 1928, pages 315; and also in Tonindustrie Zeitung, 1924, number 83, page 929.

Half-Burnt Dolomite

A very wide field for this half-burnt dolomite is as a substitute for caustic-burnt magnesite in the sorel cement industry. Experiments have been carried out by the author and by other investigators to obtain mixtures of magnesia and calcium-sulphate by the double decomposition of burnt dolomite and magnesium sulphate and to use these mixtures for the aforementioned purpose. Although the results that were obtained in these investigations led to the attainment of a patent and seemed to indicate that very good results could be obtained with the process and that the products possessed high-early strength, the application of this process in practice has become less in time. It was found that there were a number of pertinent reasons for this. In the first place, a mixture of magnesia and calcium-sulphate is not stable, for the reason that the contact of this mixture with carbon-dioxide causes a conversion into potassium-carbonate and magnesium-sulphate, with the result that the product made from this mixture loses strength and becomes useless. Hence, the use of the mixture $CaSO_4.2MgO$ must be avoided.

Differences Between Dolomites

Technical men know that calcium-carbonate can be considered a stable substance so far as the preparation of artificial stone is concerned, for it does not react with the other substances that are

added in making up the mixture. It follows that injurious effects and by-reactions are not to be feared when this substance is used in combination with magnesia, which is the form in which it occurs in half-burnt dolomite. Many tests and investigations on this problem have revealed the astonishing fact that there is an essential difference between the crystalline and the amorphous varieties of dolomite. An attempt has been made to explain this difference as due to a mixture or solution of the ingredients. However, this assumption has not been substantiated.

The author has established, from the numerous investigations that he has conducted on dolomites, that the two kinds of dolomite differ markedly in weight per unit volume in the half-burnt and in the ground condition. The ratio is 1.25 to 0.82 for the amorphous dolomite, and hence this substance has a specific weight close to that of caustic magnesite. It is enlightening to learn that the lighter product is more active in use, for the reason that the latter has a greater surface area for a given weight.

The observation has been made also that the amorphous dolomite can be burnt at lower temperatures than the crystalline variety. This is similar to the behavior of calcium-carbonate. The following experimental results show the different behaviors of crystalline and amorphous dolomites when heated at different temperatures. One gram of the dolomite is tested in each case and the number of cubic centimeters of carbon-dioxide obtained is indicated:

Temperature	Crystalline Dolomite	Amorphous Dolomite
700 deg. C.	4 c.c.	16 c.c.
750 deg. C.	20 c.c.	90 c.c.
800 deg. C.	80 c.c.	125 c.c.
850 deg. C.	125 c.c.	125 c.c.

Strong evolution of carbon-dioxide gas took place at 800 degrees C in the case of the crystalline dolomite and at 750 degrees C in the case of the amphorous variety.

It is evident, from the above results, that the amorphous dolomite is half-burnt at a temperature of 800 degrees C, while the crystalline variety is half-burnt at a temperature of 850 degrees C. It is not possible to drive out the carbon-dioxide combined with the magnesia in complete manner at a temperature of 800 degrees C when crystalline dolomite is heated. This behavior is of great practical importance, for the main consideration in the process of obtaining half-burnt dolomite is to attain the decomposition temperature of magnesium-carbonate without raising the temperature to so high a point that the calcium-carbonate also is decomposed. If the span between these two temperatures is fifty degrees greater, the performance of the burning process becomes considerably easier while, on the other hand, it is always more difficult to maintain the correct temperature, the smaller the temperature range. For this reason the experiments that have been made, to the present time, in the attempt to obtain a half-burnt product from crystalline dolomite have been unsuccessful.

There is still another and an advantageous way in which the amorphous modification of dolomite varies from the crystalline variety. It is more reactive than the latter. Methods are described in literature for the determination of the free magnesia content of dolomite in the half-burnt state. Samples of the latter are heated with water and ammonium-chloride, and the amount of ammonia in the distillate is determined. It has been proved, however, that this method is completely inapplicable, for the reason that too high a magnesia content is found with it. This is due to the fact that calcium-carbonate also reacts with the ammonium-chloride, liberating ammonia. When the heating is prolonged then the entire calcium-carbonate is converted into lime and determined as magnesia.

However, when half-burnt dolomite obtained from the crystalline variety of the rock is investigated in this manner, the decomposition of the calcium-carbonate is considerably slower. Thus, when the raw material, that is, the unburnt dolomite, is distilled with ammonium-chloride, the same difference in behavior between the two varieties of rock is observed. Experiments were carried out to establish the exact conditions under which this action takes place and such working conditions were maintained constant. One gram of the finest pulverized crude dolomite was heated with water and ammonium-chloride, and the amount of ammonia evolved was determined by volumetric analysis. Thus 0.140 gram of ammonia was obtained from amorphous dolomite after it was distilled for half an hour. When lime and magnesia are determined in the filtrate which is obtained by separation of the distillation residues, then 0.120 gram of lime and 0.086 gram of magnesia are found. These quantities of lime and magnesia correspond well with the ammonia distilled over, in accordance with the reaction which takes place as depicted in the following equation:

$$CaCO_3.MgCO_3 + 4NH_4Cl = CaCl_2 + MgCl_2 + 2(NH_4)_2CO_3.$$

The result is particularly surprising. One must assume from it that the dolomite which was investigated did not consist of a physical mixture of calcium-carbonate and magnesium-carbonate but that it existed in the state of a double compound or rather a complex salt, which acted as such upon ammonium-chloride. It would otherwise not be intelligible why the carbonates react in ratios of their molecular weights, as a partial reaction must be assumed according to the different solubility of the carbonates in water: calcium carbonate 0.031 gram, and magnesium carbonate 0.094 gram, per liter of water. It is regrettable that these investigations could not be conducted on different dolomites, to a real solution of the problem. Such investigations would not only be of scientific interest, but they

would afford interesting and valuable information regarding the practical application of dolomite. They would afford also an explanation of the causes of the unsuccessful outcome of the various experiments in using dolomite for useful purposes.

Tests for Strength

The strength in tension of mixtures of dolomite was selected as the measure of the suitability of the half-burnt variety of the rock. This affords a good criterion for the applicability of the material. First, one hundred parts by weight of magnesite were used; then the same proportion of half-burnt dolomite and a mixture of magnesite and dolomite in equal parts; and the same amounts of fillers were added. Sufficient magnesium-chloride solution of 1.24 specific gravity concentration was used to obtain a moist mass which was then filled into the usual forms for the determination of the tensile strength.

The strength determined after seven days was found to be magnesite, 72 kilograms per square centimeter; dolomite, 24 kilograms per square centimeter; and half magnesite and half dolomite, 64 kilograms per square centimeter.

As can be seen from the above figures, the strength of the last mixture is considerably higher than the average of the magnesite and the dolomite figures. They show, however, that the dolomite alone in this mixture does not give much strength, and this must be a characteristic of artificial stone prepared from the latter material. The following experiment gave even a better picture of the relative strengths of dolomite. In this, the high content of calcium-carbonate in the half-burnt dolomite is taken into consideration in such a manner that different mixtures are prepared from dolomite, magnesite, and chalk, which are chemically alike.

These mixtures consisted of the following parts by weight:

	I	II
Burnt magnesite	150	150
Half-burnt dolomite	...	200
Chalk	150	...
Wood sawdust, air-dried	50	50
Magnesium-chloride, 1.22 specific gravity	125	125

The tensile strengths of the two preparations after two days were, respectively, 33 kilograms per square centimeter, and 38 kilograms per square centimeter; after seven days, 42 kilograms and 48 kilograms; after twenty-eight days, 49 kilograms and 56 kilograms. The weight of the sample used in making the tensile strength test was 104 grams in the first case and 100.5 grams in the second case.

It was determined only after these experiments had been concluded that the content of free magnesia in the dolomite was reduced from 26 per cent to 21.5 per cent due to the long and faulty storage. The tensile strength of the dolomite mixture was, in round numbers, fifteen per cent higher. When the difference in weight (100.5 to 104 grams) is taken into consideration as well as the small amount of dolomite, this figure becomes 22 per cent. The fact that the strength attained a high figure even after two days showed that the addition of dolomite did not retard the setting. It is positively deduced from the above figures that the substitution of a portion of magnesite by half-burnt dolomite must be advantageous.

Care must be taken to see that the dolomite is not burnt too much, for the reason that lime will then be found in the preparation. The extraordinarily bad influence of this constituent has been appreciated only within the past few years. The effect of the free lime is manifested in the difficulty of setting of the artificial stone preparations and the products obtained develop cracks in the course of time. Hence, it is important that the dolomite should be half-burnt only. This condition can be attained by using special kilns and apparatus in which the heating is accomplished along the sides has made it possible to obtain a product with 26 per cent of magnesia and no lime.

Sixth Annual Vermont Slate Outing

The Slate Industry of Vermont will hold its Sixth Annual Outing on June 28-29 inclusive at the Prospect House, Lake Bomoseen, Vermont. Many of the producers and guests will indulge in a short vacation to include Independence Day. The interesting program follows:

Friday, June 28—Luncheon. Afternoon and evening meetings, Board of Directors, National Slate Association.

Saturday, June 29—Morning. Quarry Managers and Auditors discussions with Dr. Bowles, of the U. S. Bureau of Mines, on proposed Uniform Cost-Keeping Methods for Slate Quarries and Mills.

2 p. m. Annual Ball Game. Granville-West Pawlet vs. Fair Haven-Poultney. First game of a new series for the Gray Foundry Cup. Other games and races. Ladies' bridge party at Prospect House.

7 p. m. Annual informal dinner. Special musical program and entertainment. Addresses by national speakers.

Golf all day at Bomoseen Country Club—$1.00 green fee. Medal score prizes, fishing, bathing, boating, etc.

Sunday, June 30—Motor trips through nearby beautiful hills and lakes of Vermont.

Note. All participants in contests must have full outing ticket.

Arkansas Bauxite Production

Arkansas produced 361,236 long tons of bauxite in 1928, valued at $2,193,230, as compared with 303,830 long tons in 1927 with a value of $1,892,860, Department of Commerce figures show. The output of bauxite from Georgia, Alabama, and Tennessee, the only other producing fields in the United States, decreased from 17,110 long tons in 1927 to 14,190 in 1928. The Arkansas production overcame this deficit and produced an increase for the United States of 17 per cent in quantity and of 14 per cent in total as compared with 1927.

Widening the Concrete Field by Use of Light-Weight Aggregate

LIGHT-WEIGHT burned-clay aggregates for concrete construction are now available in sixteen states of the Middle-west and East and in Eastern Canada. Their commercial production made rapid progress in 1928 and will more than double in 1929.

The increase in production and use of this material results from the demand of modern construction methods for lighter-weight building materials. Weight is an especially important factor in multiple-story structures which must be designed with columns and foundations of sufficient strength to carry the dead load of the building itself in addition to the super-imposed load of the occupants.

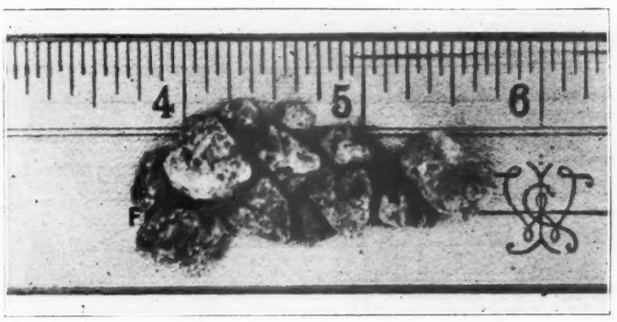
The use of light-weight aggregates has made possible a reduction of one-third in the weight of concrete for buildings of reinforced concrete design and for the concrete fire-proofing and floors of structural-steel construction. With ordinary concrete weighing approximately 150 pounds per cubic foot, a concrete of equal strength and quality weighing only 100 pounds per cubic foot permits marked economy in the amount of materials required.

The weight of a building involving the use of one thousand cubic yards of concrete would be reduced more than 650 tons by the use of lighter-weight concrete. It has been estimated that economies are effected through weight reduction in any building exceeding four stories in height.

The light-weight burned-clay aggregate at present on the market has the trade name Haydite. It is a manufactured product in which suitable shale is burned in a rotary kiln, similar to a small cement kiln. Lumps of raw shale are subjected to heat-treatment so that two important changes take place. First, a pre-heating of about 800 degrees vitrifies a thin layer on the outside of each lump, which serves to confine the gases of combustion in the interior as the heat is increased. Second, the heat increase to about 2,000 degrees softens this exterior layer, permitting the release of the pent-up gases. The result is a sudden expansion, which puffs the lumps to about two and one-half times their original size and renders the whole structure cellular.

The expanded clinker is dropped from the kiln and allowed to cool. It is then crushed and graded to standard aggregate sizes. One cubic yard of finished aggregate weighs approximately 1,300 pounds, whereas sand and pebbles weigh approximately 2,600 pounds per cubic yard.

It is not necessary to use any material other than graded burned-clay aggregate to mix with cement and water for light-weight concrete. Standard methods of water-cement control may be applied in designing the mix. However, slightly higher quantities of cement are required to obtain concrete of a desired strength than are used with ordinary materials.

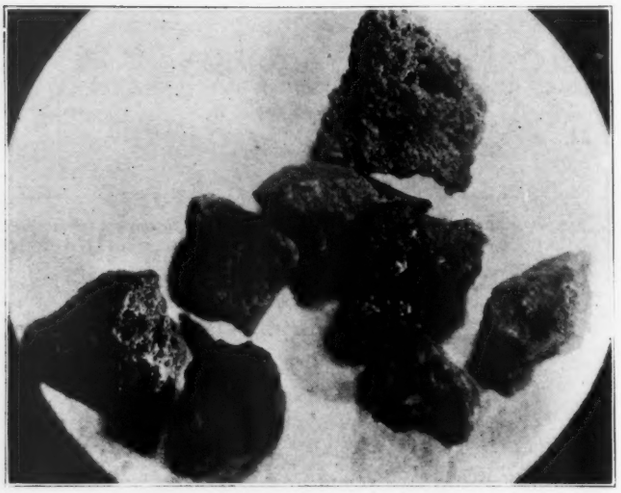


Gravel-Size Burned Clay Aggregates. Note the Porosity

Light-weight concrete for structural purposes is used for erecting new buildings to take advantage of economy in materials effected by weight reduction, and for adding new stories to existing structures where lighter-weight material makes it possible to increase the size and height of buildings without imposing unsafe loads on the original columns and foundations.

The Equitable Life Building, Des Moines, Iowa, was constructed with this light-weight concrete for fire-proofing the structural steel and for floors throughout the structure. It is eighteen stories in height, was built in 1924, and is one of the first large structures in which the lighter-weight aggregate was used extensively.

An interesting use of the light-weight clay aggregate for adding new stories to existing structures is found in the Southwestern Bell Telephone Company's Headquarters Building in Kansas City, Missouri. The foundations and columns of the original structure, erected in 1920, were fourteen stories in height. They were built of standard materials and were designed for sufficient strength to carry additional stories as the space requirements of the company increased. The plans allowed twelve extra stories to be added for office purposes, using ordinary materials. When the time came to build, Kansas City's growth had been so rapid that more than this number were needed. The only way in which this result could be accomplished was by reducing the dead load of the extension by using lighter-weight building material. Hence the addition was designed for light-weight concrete for fire-proofing the structural steel and for floors. Furthermore, masonry units made with



Magnified 8-mesh Particles of Burned-Clay Aggregate, Showing Cellular Structure

the light-weight aggregate were used for backing up the exterior walls, and for all partitions. This allowed fourteen instead of twelve extra stories to be built and the present building has a total height of twenty-eight stories.

Other buildings of note in which the light-weight feature led to the use of this material for erecting extensions include the Hudson Tower, Detroit, the Emmerman Building, Chicago, and the Chicago Athletic Club.

Another interesting use of light-weight aggregate is being developed in the construction of bridges. The lift spans of nine bridges in various sections of the country have been paved with light-weight concrete. This reduces the load of the span and thus requires less power for making the lift. On two bridges of major importance now under design, the use of light-weight concrete is planned for the entire pavement, to effect an economy in the structural steel throughout.

Masonry units manufactured from this light-weight aggregate weigh 27 pounds in the 8-in. by 8-in. by 16-in. size. In addition to their light-weight feature, they are sound and heat-insulating, due to the porous structure of the aggregate. Another desirable quality is the fact that nails can be driven directly into the masonry wall, and the units can be readily cut and channeled for plumbing and electrical installations after the masonry wall is erected.

These features are causing a wide use of the light-weight masonry units for residence and apartment house construction. During 1927 and 1928, the greatest use of aggregates was for the manufacture of masonry units. However, leaders in the industry state that the structural field will be the most important outlet for the material as it becomes more generally available and more widely known.

Heat-treated clay aggregates have opened up a new field in engineering design. The possibility of reducing the weight of concrete of satisfactory strength one-third will permit the use of concrete where it has previously been out of the question. Furthermore, engineers are envisioning new heights to which buildings can be constructed by virtue of the weight reduction. The development of these aggregates is being followed with considerable interest by the building construction industry.

Classification of Public Lands

Our federal domain—that is, all of the territory in our country that has not been acquired by its citizens under locations or patents—is classified according to its best adaptibility for different uses. Thus much of our territory was classified early as most useful for agricultural purposes, while other large areas are deemed more valuable for the exploitation of minerals. In such large areas as we possess there are always probabilities that land may fall under several classifications.

Mineral classification involves not only classifying the public lands as mineral or non-mineral but also, with respect to coal, determining whether the coal deposits present are workable, laying out leasing units in such form and of such area as to permit the most economical mining of the coal, and recommending appropriate requirements as to royalty, investment, and production. With respect to oil, it includes a determination of the existence and limits of tracts whose geologic structure is apparently favorable to oil accumulation and an estimate as to their probable contents.

An instance of such classifications may be found in the state of Idaho. Outstanding permits for mining coal on public land in Idaho include 10,897 acres, sodium permits 3,250 acres, and oil and gas permits perhaps 60,000 acres. More than 268,000 acres have been classified as phosphate land, and 4,600 acres as coal land.

Agricultural classification involves a determination of the surface utility of the public lands. More than 13,000,000 acres in Idaho have been designated as dry-farming land under the enlarged homestead act, and 5,500,000 acres as grazing land under the stock-raising homestead act. The basic facts gathered in connection with the agricultural classification of the public lands are being used in the preparation of a series of maps showing the agricultural value of the lands of the public-land states.

The manufacture of cement pipes is proposed to utilize the stone dust that is rejected in a crushed-stone plant near Swampscott, Massachusetts.

The tripoli grinding plant of the Independent Gravel Company of Webb City, Missouri, was totally destroyed by fire on May 4. Its prompt rebuilding is assured.

Prevention of Accidents Should Be Everybody's Problem

By MAJOR HENRY A. RENINGER,*
President National Safety Council

SAFETY is age old and we find many references to it in the Bible. The accident in the Garden of Eden; the instruction given to the Israelites to erect railings on their roofs; our first traffic problem—Noah and his Ark; the first no-lost-time accident—Jonah and the whale. The history of the world showed a consciousness of the need of safety, but only as an instinctive process until twenty years ago. Up until then (or a few years earlier), very little attention was paid to safety or accident-prevention work, and somehow or other no person or persons or organization accepted the responsibility; but, with the introduction into the various legislatures of numerous bills, some of which have become laws, the responsibility for accident prevention and safety of the employees was placed upon the employer.

While the employer accepted this responsibility because he was compelled to, neither he nor the employee belived that accident-prevention work was really worth while, and it was years before this work was placed upon a workable basis. In the early days, some of the railroads, the United States Steel Corporation, and a few other industries, began to realize that they could not afford to have the number of accidents they had been having in early years, so they laid out a plan of safety work. It was in Milwaukee, in 1912, that the Iron and Steel Electrical Engineers organized, in conjunction with the first cooperative safety congress, the National Council for Industrial Safety.

Pioneers in Safety

It is only through the unfailing interest and energy of these safety pioneers, who battled along for several years against what seemed an almost impenetrable wall, that they were able to attack the accident problem with any degree of success. The early days found us with few members and little income. As we look back now, after these seventeen years, the growth of the National Safety Council has been remarkable, but it has been due to the efforts of those early safety men that we have today an organization established for good, which has demonstrated not only in this country but to the world the value of safety work.

The National Safety Council is a cooperative, non-profit organization—a clearing house for information on the subject of accidents, their causes, and ways and means of preventing them, a permanent organization devoted to the promotion of safety and to the saving of human life in the industries of the United States. Today the membership of the Council is 5,000, employing over ten million persons. In addition to this there are sixty local community safety councils functioning in various parts of the country, directly serving a population of 30,000,000 people. The majority of these councils have paid managers whose entire time is given to the study of the safety problem in their own communities. One thousand committeemen are serving on the various committees of the national, local, and sectional divisions of the council, giving their time and money in furthering this great cause. The national headquarters' staff consists of 101 persons, many of them trained engineers, statisticians, librarians, artists, and printers, whose sole duty it is to collect and study information on the subject of accidents—where, when, and how they occur, and ways and means of preventing them. The budget for 1929 is over $813,000, with a local council budget of over $600,000. The income to carry on this work is derived from dues of members, sale of material, and contributions from public-spirited citizens.

Not An Industrial Problem Only

Originally the council was organized to take care of the industrial problem, but time has shown us this is not the only problem facing us. Public, school, and home safety are just as important, and perhaps more so at the present time, than industrial safety; and, in order that we can carry on this work, it has become necessary that we spend just as much time on the last three phases as we have on industrial safety. Part of our present activities is the development of a Home Safety program that will be put in such shape that women's clubs, auxiliaries, and parent-teachers' associations can carry on programs in their own organizations.

Part of our work is the popularization of new safety codes, new research studies on industrial and public problems, the extension of college and university activities, instructions in teachers' colleges on the methods of teaching safety, the establishment and development of new safety councils, and a new industrial health service.

Our problem also deals directly with public safety and our engineers and the sections that are interested in this particular phase are spending their time in making studies on accidents, causes and personnel, the subject of traffic courts,

*Excerpts from address delivered April 30, at the Third Annual Central States Safety Congress, Kansas City, Missouri.

through streets, one-way streets, playgrounds, pedestrian control in subways, safety zones, width of roads, statistics, and promotion and adoption of safety code and municipal traffic ordinances, school safety, safety patrol, and development of studies for all the grades. Contact with various educational associations and institutes are part of this big plan; in fact, there is no phase of community life today that is not being brought in contact with the safety problem.

In the early development of industrial safety (and that development still goes on), we found three stages: First, proper guarding of machinery; second, education of the workmen; third, requiring strict observance of safety practices and rules. Following these three stages, we found that results were obtained; but, with the reduction of industrial fatalities and accidents, public and home accidents began to increase, due to the trolley, the automobile, the high speed of our railroad trains, the use of gas, gasoline, electricity, the radio, the aeroplane. This means that the National Safety Council, in addition to the study of industrial safety, must study the ways and means of using these new products.

The more familiar we become with the accident prevention problem, the more we realize the responsibility that rests not only in industry but on other organizations in this country. We have come to realize that accidents are not only the problem of employer, but that they are everybody's problem—a community problem—and we must instill into the public mind a sense of individual responsibility, a duty to our fellow men.

Where Responsibility Rests

The responsibility is not only yours and mine, but it rests on our state, county, and municipal governments as well. They are beginning to realize this responsibility because the laws which have been enacted in the various states make it necessary that departments of labor and industry not only carry on inspection work but also look after the safety of the employees. Municipalities have seen the necessity of accepting the responsibility through their adoption of the various building codes, and fire-prevention and traffic ordinances, and today they are expressing more interest than ever before in this work because traffic accidents are taking a great toll of human life. In this connection the National Safety Council, cooperating with the Hoover Conference, has given the time and services of their best engineers to formulate traffic regulations that will be applicable to any community. For some reason, the motorist and the pedestrian do not consider that accidents are their problem or their responsibility.

The persons in the home have no conception of the number of fatal and serious accidents occurring therein. We have not been able to make them realize that the home produces more accidents than industry. Those of us who have studied accident prevention problems realize that accidents do not merely happen, but that they are caused by definite circumstances. Heedlessness, recklessness, inattention, ignorance, and worry are some of the principal causes, and not until we can once get the people in this country to realize that accidents do not just happen, can we reduce the public and home accidents in the same proportion that we have been able to reduce industrial accidents.

Human life today is held at a higher value than ever before, and this applies not only to the life and health of our leaders but as well to the life and health of the humblest workman and his children playing in the street. Science has developed, particularly in medicine, and there are now ways and means of combating many of the diseases which, only a few years ago, caused many deaths, such as small pox, typhoid fever, diphtheria, scarlet fever. In surgery, wonderful operations have been developed, and particularly during and since the war has it helped prolong life. With community and state authorities accepting the responsibility of health and sanitation problems, it is your job and my job to help bring to their attention their responsibility in helping to reduce accidents. If we can instill into the ten million people employed by our membership the spirit of safety and get them to realize what accident prevention work is, how necessary, and at the same time how valuable, we will have a powerful force in this country to spread the gospel of safety.

Safety Instruction in Schools

One of the most important things that we must develop in every community is the education of children in the public schools. We have found from our experience within the past ten years that the education of children has done a great deal to reduce accidents in communities that have safety as a part of their regular school program. The young child in the first grade, with his mind clear, is able to grasp the little lessons of safety that are taught with his daily work, and usually carried up to the eighth grade.

This is not only your problem and my problem, but it is the problem of all organizations, all state and municipal authorities. We cannot pass it by. We must help to educate the school authorities and the municipal authorities that have not accepted the responsibility, and we must make them see that they must pay attention to this very important work, which is just as important as any problem of roads, sanitation, fire prevention or fire protection. It is our duty to see that, wherever possible, human life is protected, whether it be through health or safety measures. To what greater, finer piece of work can you and I give our help and energies?

Central Plants for Manufacturing and Delivering Ready Mixed Concrete—IV

By J. O. DURKEE

IN THE three former installments of this article an effort was made to call attention to the advantages and disadvantages of ready-mixing plants, together with some proved information on the design and operation of a plant, and included a discussion of transportation. In this section, transportation is concluded with an addition of some thoughts on the clerical work in order to keep the proper batch going to the designated job and assist in billing and collecting for the material delivered.

The special unit for hauling ready-mixed concrete developed by the Avril Tru-Batch Concrete Company in collaboration with the LeBlond-Schacht Truck Company, consists of a revolving drum of 2-cu. yd. capacity mounted on a special 2½-ton truck with a wheelbase of 126 in. This short wheelbase is claimed to contribute to a saving in truck running time, because of the ease of maneuvering at the mixing plant and point of delivering.

A special characteristic of the body is that it is mounted transversely on the truck chassis, affording a direct chain drive from a sprocket wheel on its mounting shaft to another sprocket on a worm speed-reducing unit. A specially designed ball-bearing-equipped transmission power take-off whose speed can be varied to meet different requirements is used. The body rotates on special self-aligning S K F roller bearings and can be operated independently of the truck.

The body is filled and emptied through a watertight door operated by a gear-and-ratchet mechanism with a hand crank. No vanes or paddles are used in the rotating cylinder. The capacity of the body is 2 cu. yd. when loaded about two-thirds full. It is said to be necessary to leave the remaining space open to assure agitation of the concrete as the body revolves; since completely filling the body would result in movement of the concrete as one solid mass.

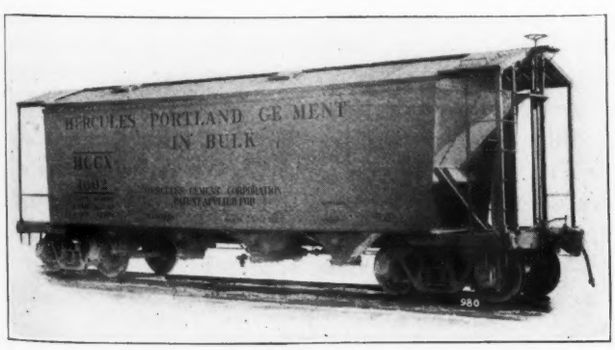
Body Truck of Avril Design

Advantages claimed for this agitator body are that it is unusually simple in design, of light weight, and rugged construction. Also, the load is always in the center of the chassis and no hoist is required for dumping. Concrete can be chuted 7 feet to the rear of the truck on road jobs, it is claimed.

The weight of the unit complete is 9,100 lb. The width of the body is 83½ in. and of the tank 64½ in. The tank has a diameter of 60 in. and the gate is 20x24 in. It is powered by a Waukesha engine with a bore of 3¾ in. and a stroke of 4½ in.

Two features of its trucks are stressed by the C. O. Bartlett and Snow Company. These are that it conditions the mixed concrete and prevents segregation without resorting to mechanical agitation, and that the truck is immediately adapted to general haulage work.

The body is of the end-dump type and differs from other bodies in that the sides consist of movable plates. These sides are brought together at the bottom forming a V and while they are in this troughed position the wet concrete is loaded. When the truck has arrived at its destination, these movable sides are wound back to a vertical position by a crank located at the front end of the body. This movement of the plates is said to cause the load to be spread over the entire bottom of the truck and any segregated fluid will mix with the mass. The



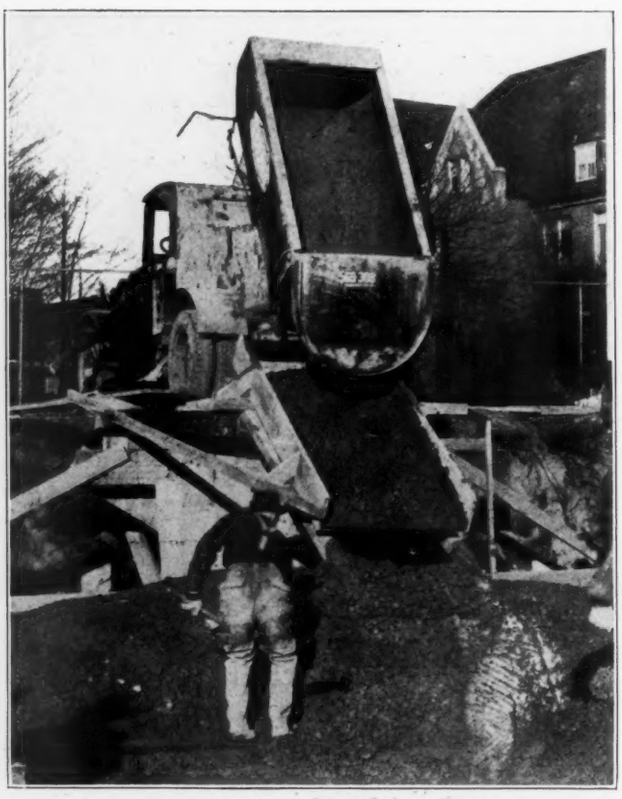
A New Steel Tank, Designed for Transporting And Unloading Bulk Cement

Concrete Delivery Truck With No Mechanical Agitator

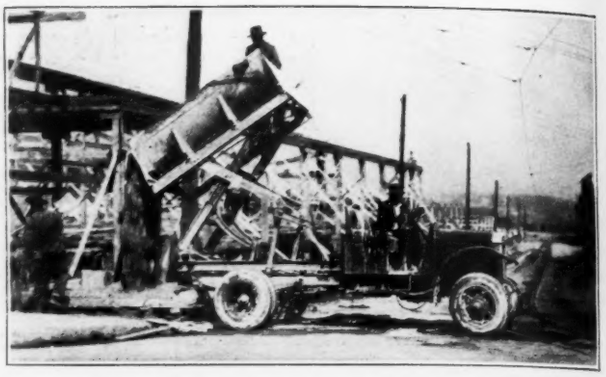
body is then tilted and the mass flows toward the delivery end, with a further conditioning taking place in the changing at the end gates.

In this truck there are no mechanical baffles or obstructions of any kind within the body. This feature makes the truck readily adaptable for other duties since with the sides in a vertical position it forms an ordinary rectangular end-dump body. The body is mounted on a special high-lift hoist which adds to the distance that the concrete may be chuted direct from the body.

A bathtub type of body for ready-mixed concrete has been developed by the Wood Hydraulic Hoist and Body Company. It is claimed that the semicircular bottom prevents the wet mix from sticking, since an equal pressure is exerted downward and in from the curved sides. The front end of the bottom has a long slope instead of a true radius, which is said to break the vacuum and permit the material to fall away freely. The tail gate is made perfectly watertight and no sharp corners of any kind are utilized in the body, which is constructed of eight-gage, blue annealed sheet steel hot-riveted throughout. The body has extension sides so that when a one batch load is hauled the additional height of the sides and a 6-in. top flange which is turned in prevents the wet mix from spilling. The body may be mounted as a high-lift unit, permitting an increase in its chuting range. It may also be fitted with mixing apparatus or paddles for mixing or agitating in transit.



Wood Bath Tub Body and Hydraulic Hoist. Note Flange to Prevent Spilling



Wood Hydraulic Hoist and Wet Mix Body

The special body for handling wet concrete developed by the Hug Company claims for its outstanding characteristics the instant release of the entire wet batch of material and the remixing of the concrete during dumping. Other features are simplicity of design and automatic operation. The body is furnished exclusively on its own truck chassis in order to provide a well-balanced unit and to insure correctly designed equipment, according to the manufacturer. The body dumps from the rear by means of a St. Paul underbody hydraulic hoist, controlled from the driver's seat. The entire body shell is elevated by toggle arms in such a manner that the batch, in falling through rigid cross members of the body, is thoroughly remixed and dumped. The upper part of the body shell leaves the lower portion of the body, the latter forming a chute for the release of the wet concrete as the body is being raised.

The remixing feature is done by a baffle cross-division plate near the center of the body. Since the wet concrete leaves the body as the body begins to rise, the concrete slides out under the baffle cross-member, which is intended to force the top water and cement down through the mass, precluding any possibility of the top of the load slushing off. Another feature of the body is that it permits the dumping of a partial load by regulating the separation of the two parts of the body.

The truck-mixer body developed by the Smith-Hamburg-Scott Welding Company, Inc., utilizes a spiral mixer arrangement of reversible baffles which should assure perfect mixing of the concrete, at the same time eliminating the necessity of a body hoist for dumping. The mixing is accomplished by revolving the spiral through a chain-drive power take-off from the truck transmission.

A Hug Truck in Dumping Position

When dumping, the power take-off is placed in reverse and this forces the concrete out into shunts for either side or rear delivery.

The body consists of a steel tank supported on a flexible truck mounting and equipped with the patented spiral. It is available in 2-, 3- and 4-cu. yd. sizes for mounting on a truck chassis of any make with capacities from 3½ up to 7 tons. An important characteristic of the body is that the motor exhaust furnishes heat for freezing-weather delivery. A water tank is attached to each side of the shell, one to furnish water for mixing while the other carries water to flush the drum on the return trip. Another advantage of the design of this body is that it is set low on the truck chassis to assure speedier driving safety as well as a clear rear view.

The Standard Steel Works has developed the Standard bath-tub type dump body to solve the problem of handling ready-mixed concrete. The smooth semi-circular construction of the body and the elimination of all sharp corners prevent the wet mix from sticking, and tapering the body from front to rear prevents choking in the discharge. This body, which is usually equipped with a Wood underbody hoist, empties quickly, cleans thoroughly and cannot twist in the dump position. Special tailgate construction makes it possible to control the discharge for dumping into a chute or a wheelbarrow. The top of the body is flanged to prevent splashing when rapidly transporting the mixture. It is shown mounted on a White truck.

The Standard ramp and hopper has been designed to be used in connection with ready-mix concrete dump bodies. The capacity of the hopper is greater than that of a large dump body so that the truck driver can discharge his entire load upon arrival and get away without waiting for individual barrows or buggies to be filled. The use of the ramp and hopper is said to reduce the number of trucks from 33 1/3 to 50 per cent. Two sets of wheels are furnished, one for the horizontal section and one for the incline section so they can be easily moved from job to job and set up with the minimum of delay.

Cost of Manufacturing and Prices Of Ready-Mixed Concrete

This discussion of delivering ready-mixed concrete would be incomplete without including some information on costs and prices. This is done in order that this series of articles will contain a considerable amount of practical information. Prices depend on cost of materials, either purchasing or selling, labor, depreciation, insurance and all items considered for a specific locality.

Some examples are taken from a treatise by A. A. Levinson, chief engineer, concrete control division of the Blaw-Knox Company. From our investigations we find them to be carefully compiled and in an exceptionally unbiased manner given to those interested in ready-mixing plants.

"At a northeastern ready-mixed plant, a 1-2-4 mix is sold for $8.25 per cu. yd. within a radius of 2 miles haul. The actual cost of producing concrete including all overhead, materials, labor, etc., f.o.b. the plant is $5.50. Sand costs $1.50 per ton; gravel $1.35 per ton, and cement ½c per pound in the bin. Common labor costs 80c per hour. A 25c per cu. yd. discount is allowed for cash and an additional 25c per cu. yd. discount is allowed on orders of 100 cu. yd. or more.

"A southeastern plant quotes the following prices f.o.b. the job:

1:1½:3 mix.....	$9.00 to	$10.00	per cu. yd.
1:2:4 mix.....	8.00 to	9.00	per cu. yd.
1:3:6 mix.....	7.00 to	8.00	per cu. yd.

The higher prices are for the longer hauls; the lower prices for the shorter hauls.

Standard Steel Works Body Mounted on a White Truck, Standing on a Standard Ramp and Dumping Into a Standard Hopper

ORDER

SUPERIOR CONCRETE DELIVERY CO.
Winfield St.
JONESVILLE, N. Y. Phone Bengal 033

Order No._____
Date_____, 1929
Terms_____

Charge to_____

Deliver to_____

_____Cubic Yards Concrete
Mix_____
Slump_____
Lb. Comp_____
Price Quoted $_____per Cubic Yard
Delivery Schedule_____ Cubic Yards per Hour beginning_____
Signed_____
Accepted by_____

Suggested Order Blank that Gives Mix, Delivery and Billing Information.

"Another plant in the northwestern part of the country has the following price list on concrete:

1:2:3 mix	$7.45 per cu. yd.
1:2:4 mix	6.80 per cu. yd.
1:2½:5 mix	6.20 per cu. yd.
1:3:6 mix	5.80 per cu. yd.

To these prices, the hauling charge is added as follows:

Within 1 mile	$0.75 per cu. yd.
From 1 to 2 miles	1.00 per cu. yd.
From 2 to 3 miles	1.20 per cu. yd.
From 3 to 4 miles	1.40 per cu. yd.
From 4 to 5 miles	1.55 per cu. yd.
Over 5 miles, $1.55, plus 20c per yard mile.	

"Another northeastern plant quotes the following prices:

	Per cu. yd. at yard	Per cu. yd. on job 1 mile rad.
1:2:3 mix	$11.25	$12.75
1:2:4 mix	10.25	12.00
1:2½:5 mix	10.00	11.75
1:3:6 mix	9.50	11.25

At this plant, sand costs $2.25 per ton; gravel $1.85 per ton; cement 55c per lb.; common labor 50c per hour.

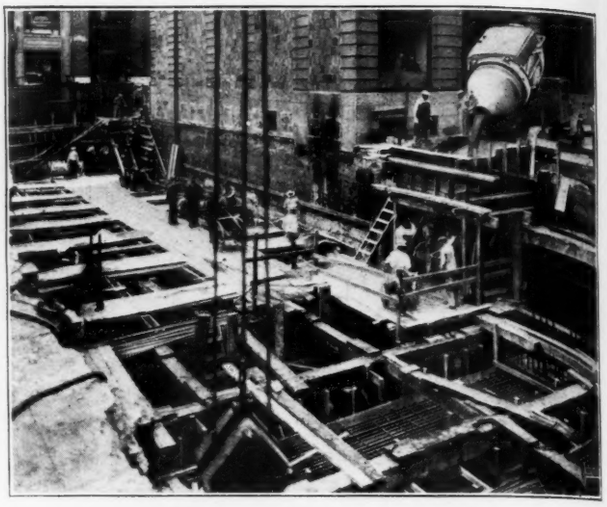
The total costs of materials per cu. yd. of concrete is	$6.11
The total costs of labor per cu. yd. of concrete is	0.24
The total costs of overhead per cu. yd. of concrete is	0.30

(This item includes depreciation on equipment, repairs to equipment, water, electric power and taxes.)

The total cost of general expenses per cu. yd. of concrete ..... $ .03

(This item includes all insurance, office supplies and advertising.)

Total cost per cu. yd. $6.68



Continuous Foundation Pour on San Francisco Stock Exchange Building. Transit Mixed Concrete Used

Some very interesting figures relative to cost have come in from Mr. Stephens of the Golden Gate-Atlas Materials Company, which is at present operating six Paris transit mixers.

These mixers are now averaging 736.5 cu. yd. per month per mixer, with an average number of eight hours per day per mixer. The gasoline cost per mixer per month figures out 11c per cu. yd.; the driver's wages 24c per cu. yd. Taking all the mixers and striking an average, we find the average cost for materials is $5.18 per cu. yd. If Golden Gate-Atlas Materials Company were a producer of sand and gravel, and did not have to buy materials in the open market, this cost would be considerably less. The average selling price of all the mixes per month, per cu. yd. of concrete is $7.75. This figure takes in all types of mixes, usually running 1:2:5½ to 1:3:6. Naturally, these mixes are much less expensive than the richer ones. Probably fifty per cent of the business today is on large jobs running all the way from 5,000 to 20,000 cu. yd. of concrete per job, and on volume orders it is necessary to grant some price concessions. A large percentage of its work runs considerably in excess of this $7.75 figure.

The repair and up-keep expense per mixer, which includes tires and all truck expense, figures 9c per cu. yd. of concrete. The average time required to load each mixer is 2¾ minutes.

The total costs of operation, including plant up-

SUPERIOR CONCRETE DELIVERY COMPANY

Date_____, 1929 — Daily Job Sheet

Ticket No.	JOB			JOB			JOB			JOB			JOB			JOB			JOB			JOB		
	Truck	Left	Back	Truck	Left	Back	Truck	Left	Back	Truck	Left	Back	Truck	Left	Back	Truck	Left	Back	Truck	Left	Back	Truck	Left	Back

Suggested Record Sheet for Giving Location of Delivery Trucks.

OFFICE COPY

SUPERIOR CONCRETE DELIVERY CO.

Manufacturers of Ready-Mixed Concrete

Winfield St.

JONESVILLE, N. Y.

Date_____, 1929

Contractor_____

Deliver to_____

Truck No._____ Zone_____

Yards	Strength
Mix	Slump
Class of Work	Aggregate

Leave Plant_____ Arrive Job_____

Leave Job_____ Arrive Plant_____

Inspected by_____

Signed_____

No. 6236

Suggested Form in Triplicate, for Customer, Office and Auditor, Gives a Complete Record of Each Truck Delivery.

keep expense, depreciation, depletion, taxes, interest, and all truck expense, all losses—in other words, the total overhead—averages $1.23 per cu. yd. In short, if we add $1.23 to the $5.18 and deduct the sum from $7.75, we will have the net profit per cu. yd. of concrete, which in this case happens to be $1.34. We can readily see that, had this company been a producer of materials, this profit could easily have been increased 50c to 75c per cu. yd. It may also be interesting to you to know that Golden Gate-Atlas pays the same prices for materials, including cement, as the larger contractors in San Francisco.

Tests of Transit System Mixed Concrete

We have just received from the testing laboratories of Abbot A. Hanks, Incorporated, the result of six recent tests. These tests involved twelve cylinders taken of transit system mixed concrete, delivered by the Golden Gate-Atlas Materials Company of San Francisco, over a period of several days.

The mix was the same in all cases, being 1:2:4, using 1½ in. maximum size gravel and 10 per cent hydrated lime. The results of these tests are as follows:

Pair Cylinders	Slump	7 days lb. per sq. in.	28 days lb. per sq. in.
No. 1	5 in.	1595	2503
No. 2	5 in.	1448	2679
No. 3	4 in.	1447	2493
No. 4	3.5 in.	1857	2886
No. 5	4 in.	1530	2274
No. 6	4 in.	1525	2309
Average	4.25 in.	1567	2524

The uniformity of these tests is quite interesting when we consider the fact that concrete authorities claim that the addition of 10 per cent hydrated lime will decrease the strength at twenty-eight days, 11 per cent. On this basis, the average strength of this 1:2:4 mix would be very nearly 3,000 pounds per square inch at twenty-eight days.

PIT AND QUARRY has taken the lead in supplying information to those contemplating the installation of systems for delivering ready-mixed concrete. We are interested in discussions, especially from operators who are successfully operating such plants. We are also in a position to answer questions relative to the opportunities offered in this rapidly growing field.

The most logical companies to engage in the ready-mixing business are large producers of aggregate, as will be noted in the discussion of the costs as supplied by the Golden Gate-Atlas Materials Company, and as observed in the different plant descriptions recently published in PIT AND QUARRY. The second class of firms are material dealers, as they have much of the nucleus of the ready-mixing installation and a contact with producers which is of value in studying costs.

Road Builders Invited to Exhibit In Chili

The American Road Builders' Association has received an invitation to participate in the International Railroad and Road Exposition which will be held by the Chilean government December 10th to 31st, 1929.

This association has organized its Pan American division, the work of which will be scientific and educational and consist of information, assistance and development that will tend to enlarge highway programs in Central and South America. Although there has been considerable road work in the South American countries, its amount is only a fraction of what will be carried on within the next few years.

After some doubt about the matter, a decision has been reached to hold the second Pan-American Congress in Rio Janeiro, August 16 to 31. Final word is so late that our manufacturers will not have time to make plans and send much equipment to this Congress. Charles Upham, secretary-director of the association, states that representatives will attend the Congress and the accompanying Exposition and that he will render assistance to all manufacturres in this country who may desire to prepare exhibits.

Oregon Lime Deposit

Interest in lime and cement deposits near Lakeview, Ore., has been revived since the interest shown by representatives of a mining syndicate analyzed samples and found them of high grade.

The deposits are extensive, and one of the mining engineers said that the cement deposit was the largest of its kind he had ever surveyed.

Bureau of Mines Announces the 1928 Winners of The National Safety Competition

By W. W. ADAMS*
Supervising Statistician

THE RESULTS of the fourth annual safety contest, known as the National Safety Competition, conducted by the United States Bureau of Mines, have been announced. A bronze trophy, Sentinels of Safety, the gift of the Explosives Engineer magazine, has been awarded to the leading mine in each of the five groups into which the mines and quarries that participated in the contest were arranged. These five groups were Anthracite mines, bituminous coal mines, metal mines, non-metallic-mineral mines, and quarries and open-pit mines. The leading plant in each group was the mine whose employees lost the smallest number of days from accidents in proportion to the total number of man-hours worked. Where two or more mines operated without a lost-time accident, the winner was adjuged to be the plant which operated the largest number of man-hours during the year.

The contest was based upon reports of accidents and exposure sent by the competing companies to the Bureau of Mines. Records of the five leading companies in each group were made known to a committee of award, consisting of the following seven members: H. Foster Bain, secretary of the American Institute of Mining and Metallurgical Engineers; James F. Callbreath, secretary of the American Mining Congress; W. H. Cameron, managing director of the National Safety Council; H. L. Gandy, secretary of the National Coal Association; A. T. Goldbeck, director of the engineering bureau of the National Crushed Stone Association; William Green, president of the American Federation of Labor; and A. J. R. Curtis, assistant to the general manager of the Portland Cement Association. Members of the committee voted for the winning company in each group in accordance with the rules governing the contest. A majority vote prevailed.

Eligibility to enroll in the contest was limited to mines employing at least fifty men underground and to quarries or surface mines employing at least twenty-five men inside the pit. However, the contest covered employees in surface shops and yards connected with the underground or quarry operations. In some cases the number of employees fell below the minimum permissible under the rules and this fact automatically eliminated the plants as contenders for a trophy. Still other plants that were enrolled at the beginning of the contest period had to discontinue as contestants either because mining operations ceased or for other reasons.

When the contest period closed, it was found that the mines and quarries that had participated in the competition, including those which had ceased to be formal contenders for a trophy, numbered 284. Men employed at these plants worked 91,746,707 man-hours and received 6,109 lost-time injuries which resulted in a loss of time or period of disability equal to 900,182 man-days. The accidents included 110 deaths, 1 permanent total disability, 121 permanent partial disabilities, and 5,877 temporary lost-time injuries. A lost-time injury is defined as an injury that disables an employee for more than the remainder of the day on which the accident occurred. All days of disability were counted, whether they were Sundays, holidays, or days on which the plant was idle. The mines and quarries that participated in the contest were situated in 35 states.

Of the 284 mines and quarries in all five groups in the contest, 42 plants were operated during the year without a single lost-time accident. The 284 plants represented 91,746,707 man-hours of exposure. Thirty-four of the 129 plants in the quarry and open-pit mine group had no lost-time accident. Four of the 48 metal mines were operated without an accident. Three of the 19 mines in the non-metallic mine group also had no lost-time accidents.

A comparison of the results of the contest of 1928 with those of the contest of 1927 shows that the metal-mine group lowered its frequency rate but had a small increase in its severity rate, the latter being due to an increased fatality rate. The non-metallic-mineral mine group had increases in both frequency and severity rates. The quarry and open-pit mine group had a lower frequency rate but a higher severity rate. The combined rates for all five groups showed a reduction of 8 per cent in frequency and an increase of 4 per cent in severity.

The *accident-frequency* rate indicates the number of accidents (including fatalities, and permanent and temporary lost-time injuries) per million man-hours of exposure or employment of all employes at the mine. The *accident-severity* rate indicates the number of lost days, or period of

(*Continued on Page* 66)

* Excerpts from Serial No. 2938 Reports of Investigations, U. S. Bureau of Mines.

Relative Aging of Gelatin Dynamites Containing Nitroglycerin and Ethylene Glycol Dinitrate*

By A. B. COATES † and G. ST. J. PERROTT §

DURING the last three years the use of ethylene glycol dinitrate (E. G. D.) as a low-freeze (L.-F.) agent in place of nitropolyglycerin has become common in the manufacture of explosives of the dynamite type.

The usual proportion of E. G. D. in the explosive "oil" is 25 per cent; the remainder, 75 per cent, is regular nitroglycerin. These proportions were probably selected as a continuation of the practice of 25 per cent nitropolyglycerin and 75 per cent regular nitroglycerin.

By numerous tests it has been shown that the substitution of 25 per cent of E. G. D. for the nitropolyglycerin in permissible explosives does not affect their safety. All of the nitroglycerin types of permissible explosives with the E. G. D. substitution have been directly compared with the corresponding types of regular composition and in no case has any appreciable difference as regards safety been evident.

A comparison of the physical properties of freshly prepared permissible explosives, such as rate of detonation, propulsive strength, sensitiveness, and gaseous products of explosion showed that the propulsive strength and gaseous products were unchanged by the substitution, while the rate of detonation and sensitiveness were slightly increased.

As reports from the users of explosives seemed to indicate that explosives containing E. G. D. stood up better under storage conditions than the corresponding regular explosives, it was decided to carry on a series of comparative tests over a period of at least two years to determine the effect of E. G. D. on the physical properties of aged explosives. Accordingly, rate of detonation, propulsive strength, and sensitiveness were determined on explosives at ages of 1, 3, 6, 12 and 25 months.

Explosives Used in Tests

As the gelatin dynamites are in the class of explosives most affected by aging, four of the five explosives selected for the comparative tests were of that class—namely, 25, 40, and 60 per cent strength gelatin dynamites, and 60 per cent strength ammonia gelatin dynamite. The fifth explosive was a 40 per cent straight nitroglycerin dynamite of the same composition as the Pittsburgh Testing Station standard.

Tests with the permissible explosives had indicated that the differences in the physical properties of the comparative samples might not be very marked; therefore, to make these differences more pronounced, it was decided to increase the E. G. D. in the liquid explosive ingredient to 50 per cent. The comparative or regular samples were made from exactly the same lot of ingredients and in the same manner, except that the liquid explosive ingredient was 75 per cent nitroglycerin and 25 per cent nitropolyglycerin.

Propulsive Strength

The comparative propulsive strengths were determined by means of the ballistic pendulum. The results expressed in pounds are the weights of charge required to produce the same swing of the pendulum as that produced by ½ lb. of the standard 40 per cent straight nitroglycerin dynamite. This weight of charge is called the unit deflective charge (U. D. C.). It will be noted that the U. D. C. bears an inverse ratio to the propulsive strength; hence, in order to facilitate interpretation of the data, the strengths have been expressed also as percentages of the propulsive strength of the 40 per cent standard dynamite.

Sensitiveness to Detonation

Sensitiveness was determined by the halved cartridge gap test. In this test, which is one commonly employed for plant control in the dynamite industry, the sensitiveness is expressed in terms of the length of air gap over which detonation will be propagated from one cartridge to another. The cartridge was cut squarely off, so that the end which was to be fired by the No. 6 electric detonator was four inches long. The two halves, with cut ends facing each other, were rolled in three wraps of manila paper 0.005 inch thick. The cartridges were held in place with carpet tacks through the paper into the explosive, and were fired on loose, level ground. The maximum distance between the halves at which both detonated in four shots was determined, and the minimum distance at which the receiving cartridge did not detonate in four trials was also determined. The average of these distances was taken as a measure of the sensitiveness and was termed the sensitiveness number.

Rate of Detonation

The rates of detonation were obtained by means of the Mettegang recorder. In all of the tests the 1¼-in. diameter column of explosive was made up by first cutting the ends of the cartridges off and then holding them firmly against each other, end

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§ Superintendent, U. S. Bureau of Mines, Pittsburgh Experiment Station, Pittsburgh, Penna.

to end. In the unconfined tests, the cartridges were held in place by inserting them in a piece of Shelby seamless steel tubing having an outside diameter of 1⅞ inches and a wall thickness of ¼ inch. The No. 6 electric detonator used was in every case at least 4½ inches from the first measuring wire.

For the primed shots the primer consisted of one stick of 40 per cent straight nitroglycerin dynamite. Where a primer was used in an unconfined test, it was rolled up in the paper tube with the main charge, whereas in the confined shots it was held against the main charge by means of a short paper tube projecting from the steel tube so that the primer itself was not confined.

In order to get, if possible, more information on the effect of confinement, two tests were run in concrete blocks. These blocks were 20 inches in diameter and 38 inches long. The concrete was poured around the steel tubes so that it was 9 inches thick on the sides and bottoms of the tubes. The confinement at the upper or detonator end consisted of 4 inches of plaster of Paris, on top of which was placed a steel block weighing 140 pounds.

Discussion of Results

Age had no effect on the propulsive strength of any of the samples; also, there was no apparent difference between the E. G. D. and regular samples.

With the four gelatins the sensitiveness decreased slightly with age for the first year, while with the 40 per cent straight dynamite there was practically no change. At the two-year age the gelatins, with the exception of the 25 per cent, show a marked decrease in sensitiveness. The sensitiveness numbers for the explosives with E. G. D. average slightly higher than the numbers for the corresponding regular sample, except for the 60 per cent ammonia gelatin at two years.

The effect of the substitution of E. G. D. on the rate of detonation under the different test conditions has been summarized as follows:

1. **Effect of age.**—The 25 per cent gelatin dynamites showed only a slight drop in rates, regardless of conditions of test. The other gelatins showed a more marked drop in rates, especially at the year and two-year ages.

2. **Effect of ethylene glycol dinitrate.**—The explosives that contained E. G. D. seemed to have their rates elevated a little more by priming than the corresponding regular explosives. The E. G. D. explosives in general had higher rates than the regular explosives. The explosives that contained E. G. D. held their rates better with age than the regular explosives.

3. **Effect of priming.**—Priming had a marked effect on the 40 and 60 per cent gelatin dynamite and little effect on the 25 per cent gelatin, but priming in conjunction with confinement did affect the 25 per cent gelatin.

4. **Effect of confinement.**—Confinement alone produced an increased rate in most cases, but the increase was small compared to the increase due to priming, except for the 25 per cent gelatin.

General Conclusions

The following general conclusions may be drawn in comparing the explosives containing the regular nitroglycerin and those containing ethylene glycol dinitrate:

1. Propulsive strength is unaffected by age and is the same for both types of explosives.

2. Sensitiveness to sympathetic detonation is slightly greater in the case of the dynamites containing ethylene glycol dinitrate.

3. Determinations of rate of detonation indicate (with some exceptions) that the explosives containing E. G. D. show (a) slightly higher rates of detonation when unconfined, (b) slightly greater increase of rate when primed with 40 per cent straight nitroglycerin dynamite, and (c) slightly better aging properties.

Winners of National Safety Competition

(*Continued from Page 64*)

disability, represented by these same accidents per thousand man-hours of exposure. In determining the lost-time equivalent of all accidents considered together, each fatality or permanent total disability represents 6,000 lost days; each permanent partial disability represents a certain percentage of 6,000 days, depending upon the part of the body affected and nature of the injury, as shown in the scale recommended by the Association of Industrial Accident Boards and Commissions; and each temporary disability is rated according to the actual number of days of disability of the injured employee, except that the day on which the accident occurred is not counted.

The winner of the trophy in the non-metallic-mineral group was the Alpha Portland Cement Company's limestone mine at Ironton, Ohio. This mine had no lost-time accidents in 1928 and the employees worked 115,020 man-hours during the year. The mine also had no lost-time accidents in the preceding year and worked 148,594 man-hours, on which record the mine won second place in the 1927 contest and was awarded honorable mention. Thus this mine has operated two years without a lost-time accident and has worked 263,614 man-hours during that time.

A brief survey of the economic status of the granite industry in the South has been made recently by the Economic Branch of the United States Bureau of Mines.

Material Service Corporation Has New Service for Producing, Transporting, and Distributing Gravel to the Chicago District

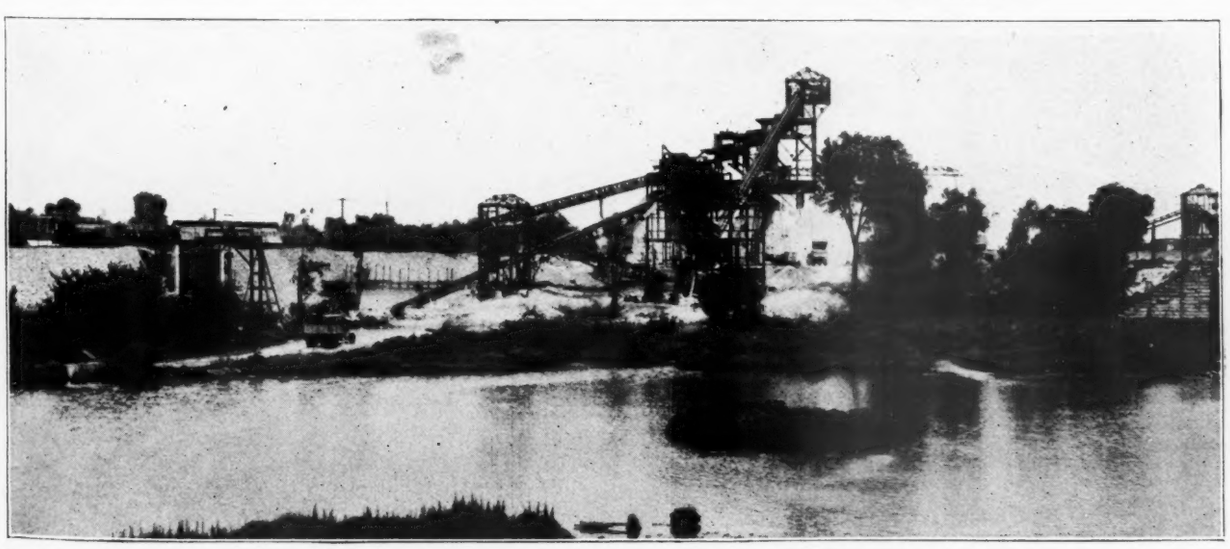
New and Modern Plants and Labor-Saving Equipment Make Possible Operating Economies Resulting In Substantial Savings to the Consumer

By W. E. TRAUFFER

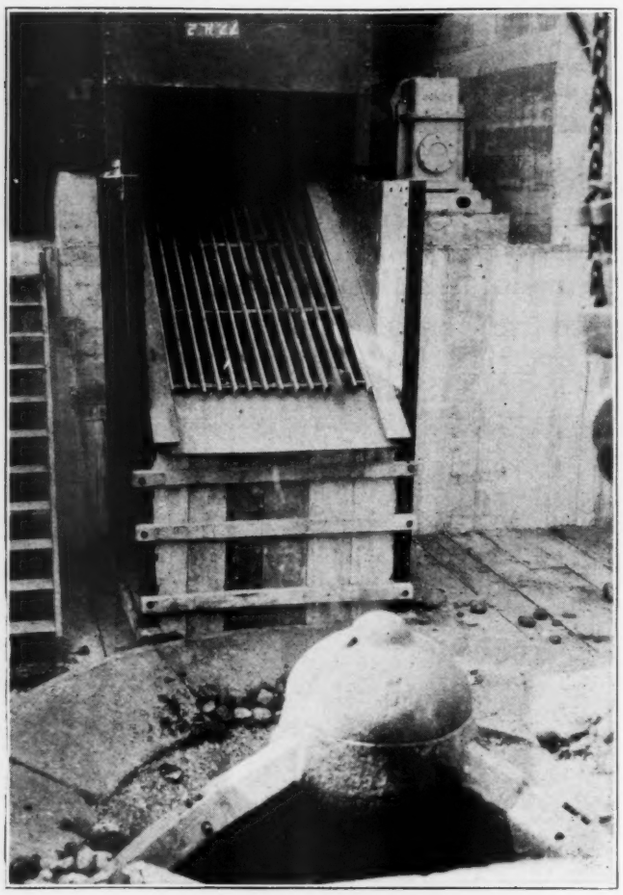
THE Material Service Corporation of Chicago, Illinois, on May 20 of this year put into operation a new system of producing and distributing sand and gravel to consumers in the Chicago district. The elimination of all unnecessary handling of the material, both at the plant and at the distributing yards in Chicago and the use of the most economical means of transportation, enables the product to be placed on the market at the lowest possible cost.

No expense or effort has been spared in the construction of the various units which make up this operation. The plant at Lockport, Illinois, is the last word in sand and gravel plants and is second to none in efficiency of operation and the quality of the product. The boat hauling the material from the plant to the docks in Chicago was designed especially to meet the unusual conditions encountered and is the first of its type to be put into operation. The South Side dock and distributing plant is also of the most modern type and, with the plant, was designed to operate with this boat or others of its type. This new system involved the expenditure of approximately one million dollars. A test plant had previously been built at Lockport to ascertain the quality of the deposit.

Irving Crown



New Paul Ales Plant from South. Cars Discharging Into Primary Crusher at Left, Screening Building and Stockpiles in Center



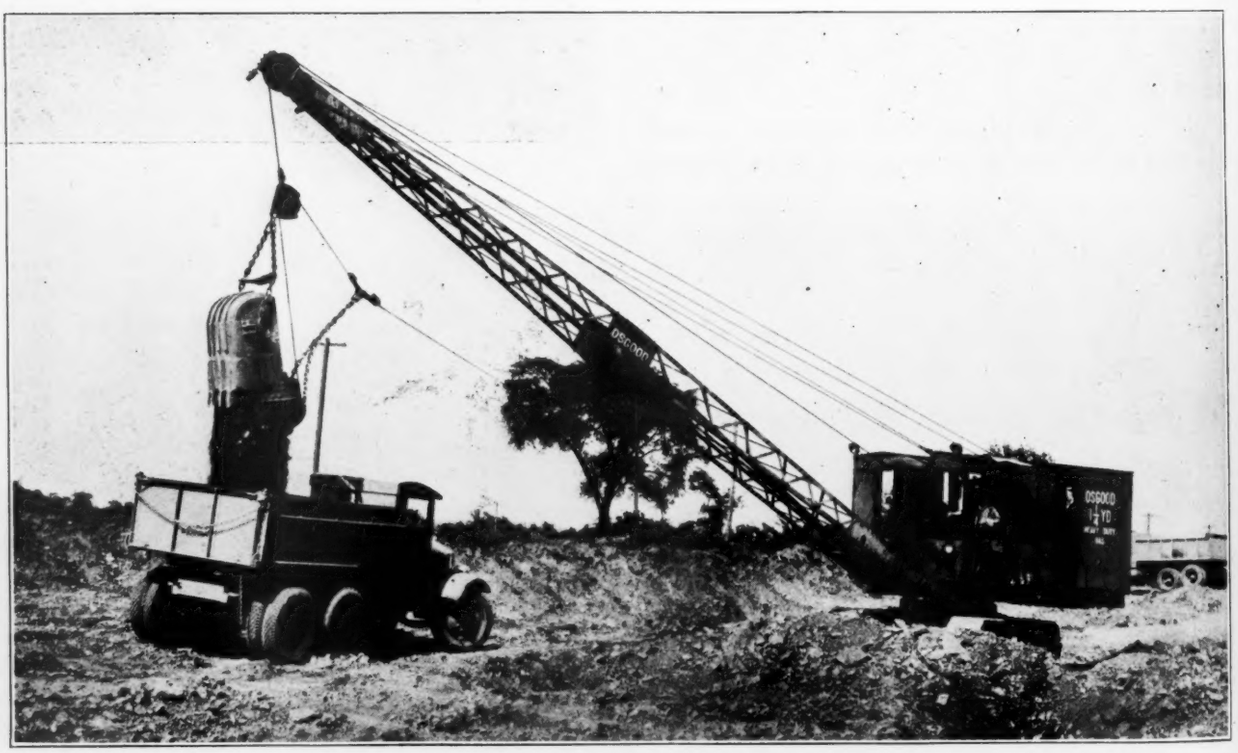
Speed Reducer Driven Feeder and Bar Grizzly Above Primary Crusher

Train of Cars Going Through Tunnel Under Highway Between Pit and Plant

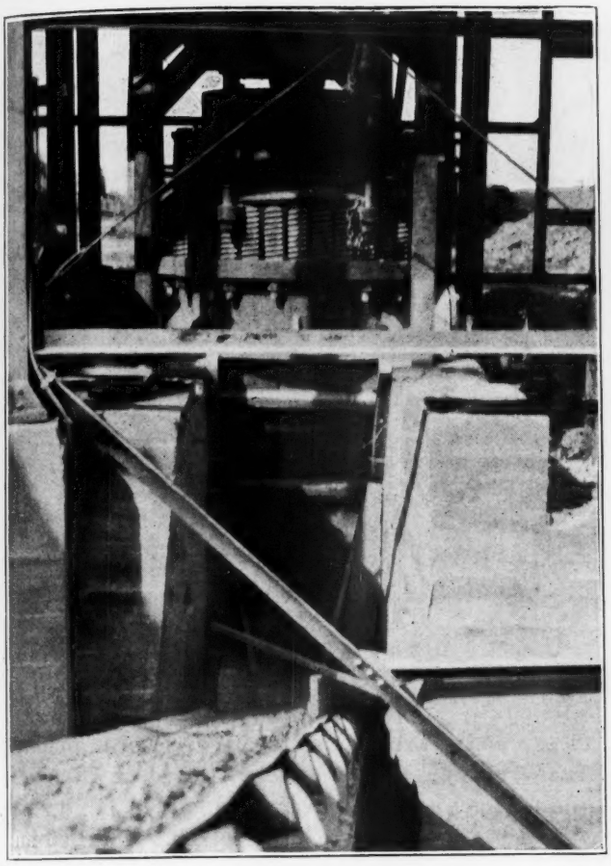
The Paul Ales Plant at Lockport

The gravel pit is on the west side of State Highway No. 4 between Joliet and Chicago at its intersection with the Lockport road. Gravel predominates in the deposit and below the gravel is limestone of good quality, which makes an ideal base for tracks and permits a large steam shovel to be used to advantage in excavating the material.

The overburden is about 4 feet in depth and is removed by an Osgood 1¼-yd. gasoline dragline operating a Page bucket. About 15,000 yards were loaded into trucks and used as fill for the railroad connecting the pit and the plant. What overburden is now being removed is sold as ballast and hauled away in trucks.



Dragline Loading Overburden Into Trucks



Secondary Crusher Discharging Onto Belt Conveyor to Transfer House

Paul Ales (Left) and Henry Crown (Right) in the Transfer House at Lockport

Excavating and Hauling the Gravel

A Bucyrus 70C caterpillar steam shovel with a 3-yd. dipper loads into trains of four 15-yd. capacity Western side-dump cars. Two of the three trains operated are each hauled from the pit to the plant by Davenport 25-ton steam locomotives and

Steam Shovel in Pit Loading Into Cars. Truck Keeps Shovel Supplied With Coal

View of Gravel Pit Showing Steam Shovel Loading and Tunnel Under Highway in Right Background

the third by a 38-ton Vulcan locomotive which was recently added to the equipment.

The railroad is about 4,500 feet long at present and consists of a single standard gauge track with several passing tracks conveniently located to allow the trains to operate with the least possible delay. In addition to the fills a good deal of concreting had to be done. A concrete tunnel was built to permit passage of the trains under the highway. In addition to this, two bridges with concrete piers and abutments and steel girders were built across the two branches of the Desplaines river separating the pit and plant. These bridges have spans respectively of 250 feet and 50 feet.

Plant Operations

The cars discharge at the plant into a 100-cu. yd. capacity concrete hopper alongside the track. A rail grizzly with 18-in. spacing over the hopper keeps out the few stones too large for the primary crusher. The hopper discharges by a Stephens-Adamson pan feeder over an inclined bar grizzly with 2-in. spacing into the No. 10 Allis-Chalmers McCully primary crusher. The crushed material and that passing through the bar grizzly discharge onto an inclined belt conveyor in a tunnel under the crusher. The pan feeder is driven through a worm gear speed reducer by a 15-hp. variable speed motor and the primary crusher by a 125-hp. motor through a Texrope drive.

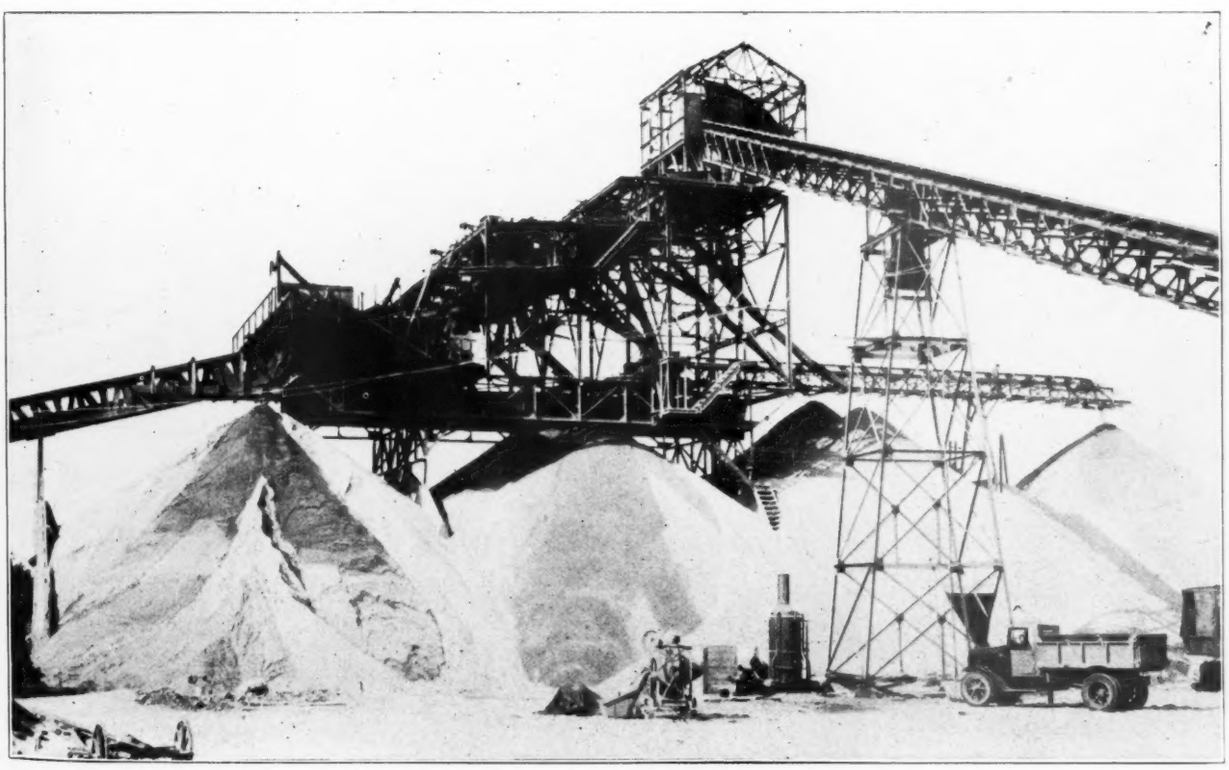
View of Screening Building and Stockpiles from East

Trainload of Gravel Going Over One of Concrete and Steel Bridges Between Pit and Plant

The conveyor to the secondary crushers is 42 inches wide with 206-ft. 10-in. centers and is driven by a 75-hp. motor through a herringbone gear speed reducer. It discharges into a split hopper feeding four Robins 4-ft. by 6-ft. Gyrex vibrating screens arranged in pairs. Each screen has 2-in. square woven mesh and is driven by a 5-hp. motor through Texrope drive.

The material passing through the vibrating screens goes to a belt conveyor to the screening plant. The oversize goes to a steel hopper feeding a Symons No. 4 cone crusher, which is direct driven by a 125-hp. motor. The crusher discharges onto a 30-in. inclined belt conveyor on 89-ft. 9-in. centers to the transfer house, which is located about midway between the primary and secondary crusher buildings. This conveyor is driven by a 15-hp. motor through a spur gear speed reducer and feeds through a chute back onto the main conveyor from the primary crusher, the material again passing over the vibrating screens.

The conveyor to the screening building is 36 inches wide on 238-ft. 7-in. centers and is driven by a 60-hp. motor through a speed reducer. The conveyor discharges into a split hopper feeding two chutes, which are also split, feeding the mate-



Screening Building and Stockpiles from Southwest

Paul Ales Plant from East Side of Drainage Canal

rial to four Stephens-Adamson Gilbert conical screens with 1¼-in. square perforations. The oversize goes through a chute to the stockpile second from the canal as 1¼-in. to 2-in. road-stone.

The material passing through these screens goes to a second set of four Gilbert screens with 7/16-in. wire mesh. The oversize goes through chutes onto a 24-in. horizontal belt conveyor on 82-ft. 5-in. centers, which discharges onto the first stockpile for 7/16-in. to 1¼-in. concrete stone. This conveyor is driven by a 15-hp. motor through a speed reducer. The material passing through this set of screens goes to a third set of four similar screens with 1¼-in. wire mesh. The oversize from ¼-in. to 7/16-in. goes to the third stockpile as roofing gravel. The material passing through the third set of screens is sand and is chuted into four Stephens-Adamson twin screw wash boxes, where the sand is thoroughly washed. The sand goes to the fourth stockpile. Each screen also has jets played on the material to insure a clean product. The waste water is flumed away from the plant. The west wall of the sand stockpile has a gate allowing sand to be loaded into trucks on a road alongside the wall.

The screens and wash boxes are so arranged that either half of them can be shut down when desired. Each half of six screens is driven by chain and

Secondary Crusher Building from West. Transfer House at Right, Conveyor to Screening Building at Left

Left to Right: Dan Ryan, vice-president; Henry Crown, president; Major Rufus W. Putnam; Irving Crown, treasurer; Bill Glaver, vice-president

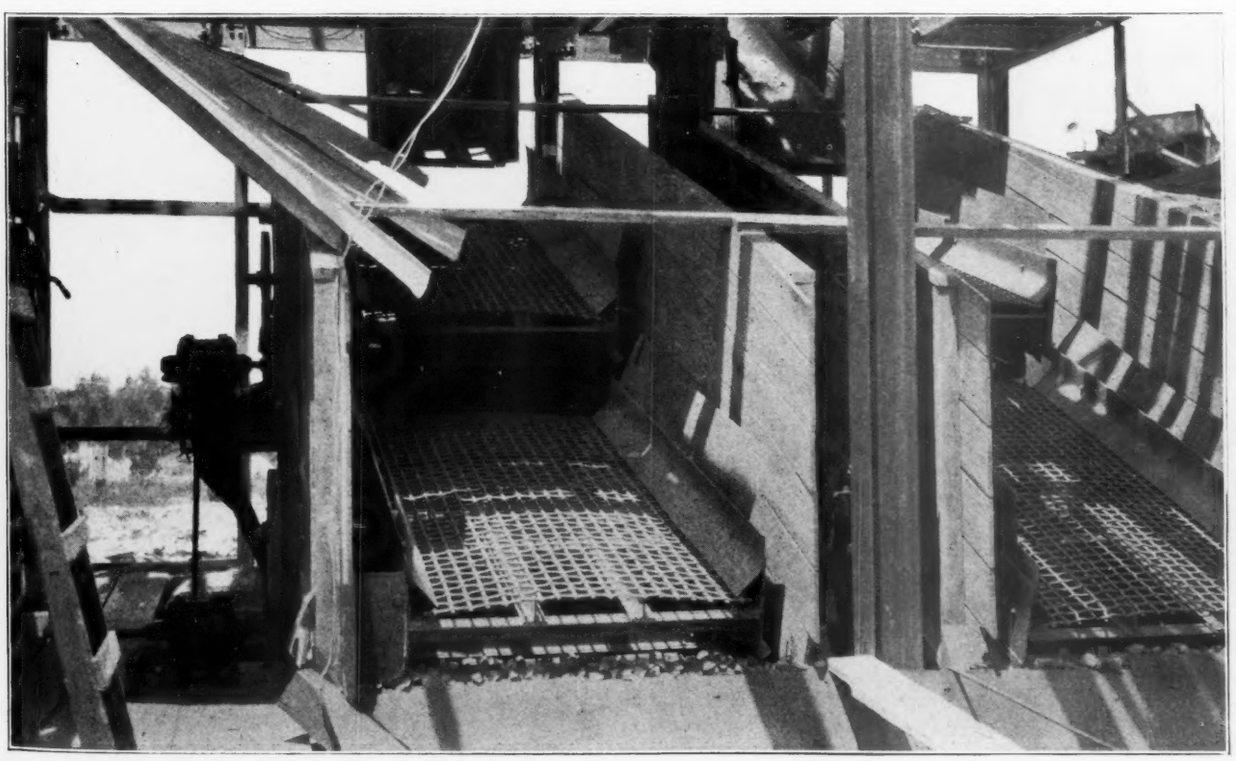
sprocket by a 40-hp. motor. Each pair of wash boxes is direct gear driven by a 15-hp. motor.

Stockpiling and Loading

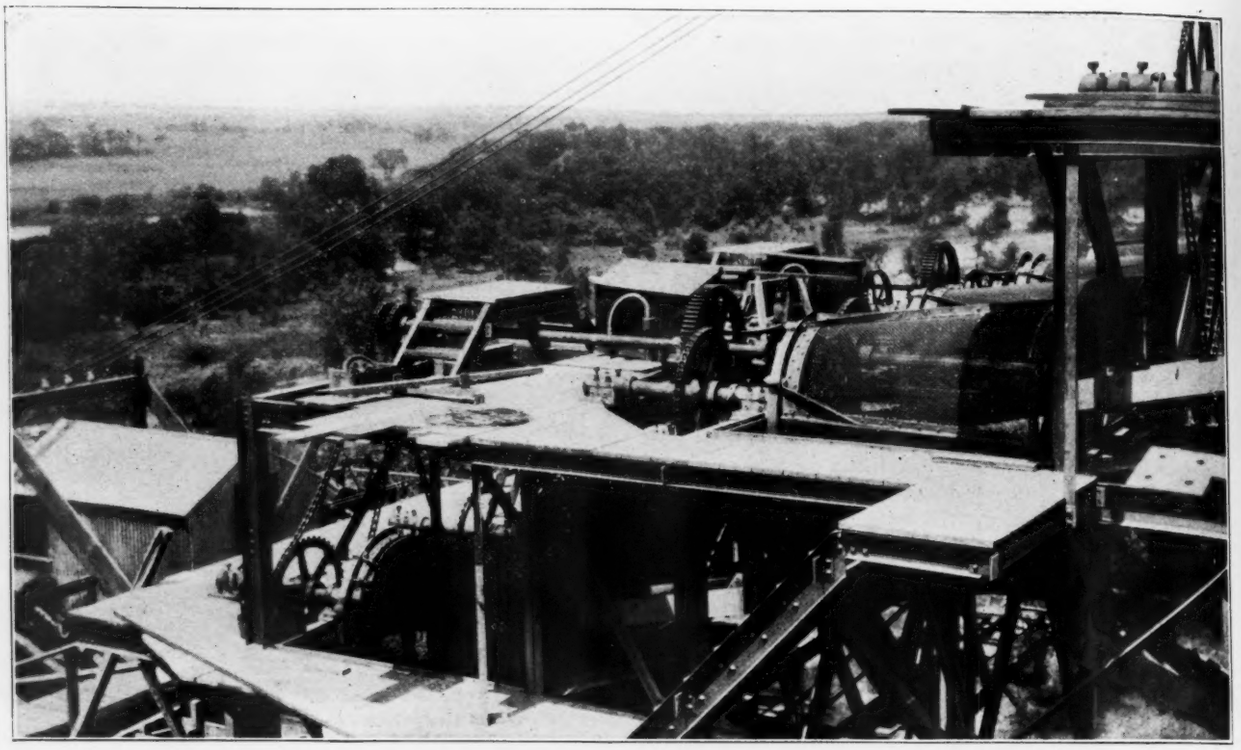
The structural steel framework of the screening building rests upon four concrete partition walls, which also serve to separate the stockpiles. A concrete tunnel under these walls and stockpiles at right angles to the dock reclaims the material in the stockpiles. These partition walls are each 25 feet in height and the tunnel is 240 feet long, 7 feet 6 inches high and 9 feet wide inside.

Gates in the top of the tunnel allow any size or combination of sizes of material desired to discharge onto a 42-in. horizontal belt conveyor inside the tunnel. This conveyor discharges onto a short 42-in. inclined conveyor, which in turn feeds the shuttle conveyor loading the boat. The tunnel conveyor is direct driven by a 75-hp. motor and the inclined conveyor is Diamond chain driven from the same motor. Combined they have a total length of 291 feet 2 inches. An automatic weigher will later be installed on the inclined conveyor from the tunnel to weigh the material as it goes to the boat.

The shuttle conveyor is housed in a structural steel building at the dock. The inclined conveyor



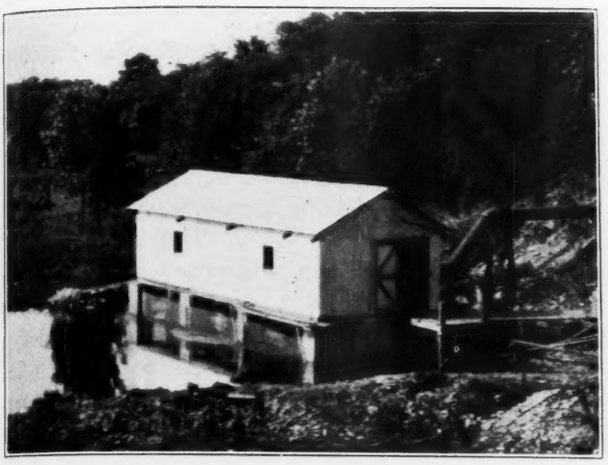
The Four Vibrating Screens in the Secondary Crusher Building. Motors Driving Two of These at Left.



Two of the Three Sets of Revolving Screens. One of Sand Wash Boxes Visible at Extreme Left

discharges onto an inclined stationary screen with 3/16-in. wire mesh, where the material is given an additional rinsing by a series of jets over the screen. The conveyor is 48 inches wide and is driven by a 15-hp. motor through a worm gear speed reducer. The travel of the conveyor is controlled by a direct-connected 5-hp. reversible motor. A travel of 50 feet allows sufficient leeway for

Plant from Southwest. Outdoor Substation in Right Foreground



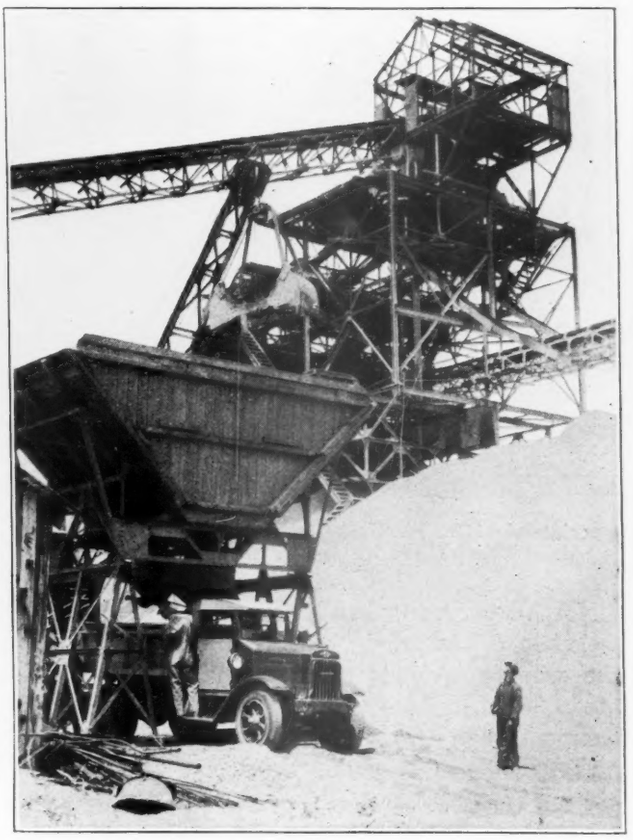
Pump House on Desplaines River Which Furnishes Washing Water for the Plant

loading into any sized boat or barge at the dock.

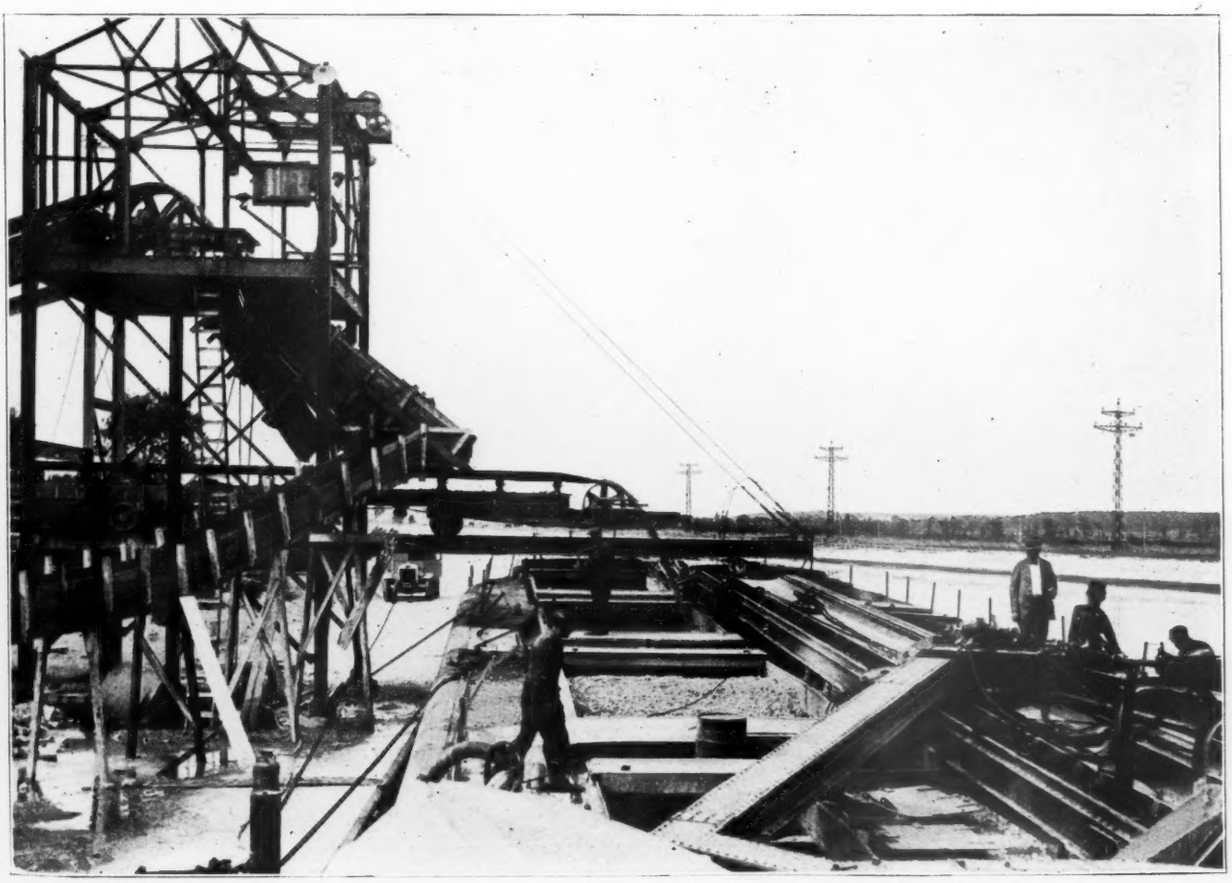
The plant capacity at present is 6,000 tons per ten-hour day. A second Symons No. 4 cone crusher is now being installed alongside the present crusher and will be fed in the same manner and discharged onto the same return conveyor. This installation will give the plant sufficient crushing capacity to take care of any future increase in production. The conveyors, screens and washers were also designed with this in mind.

Miscellaneous Information

Barber-Greene and Nelson stockpile loaders and



Truck Loading Under Batcher Bin at Lockport. Crane Handling Material from Stockpile Into Bin Screening Building in Background



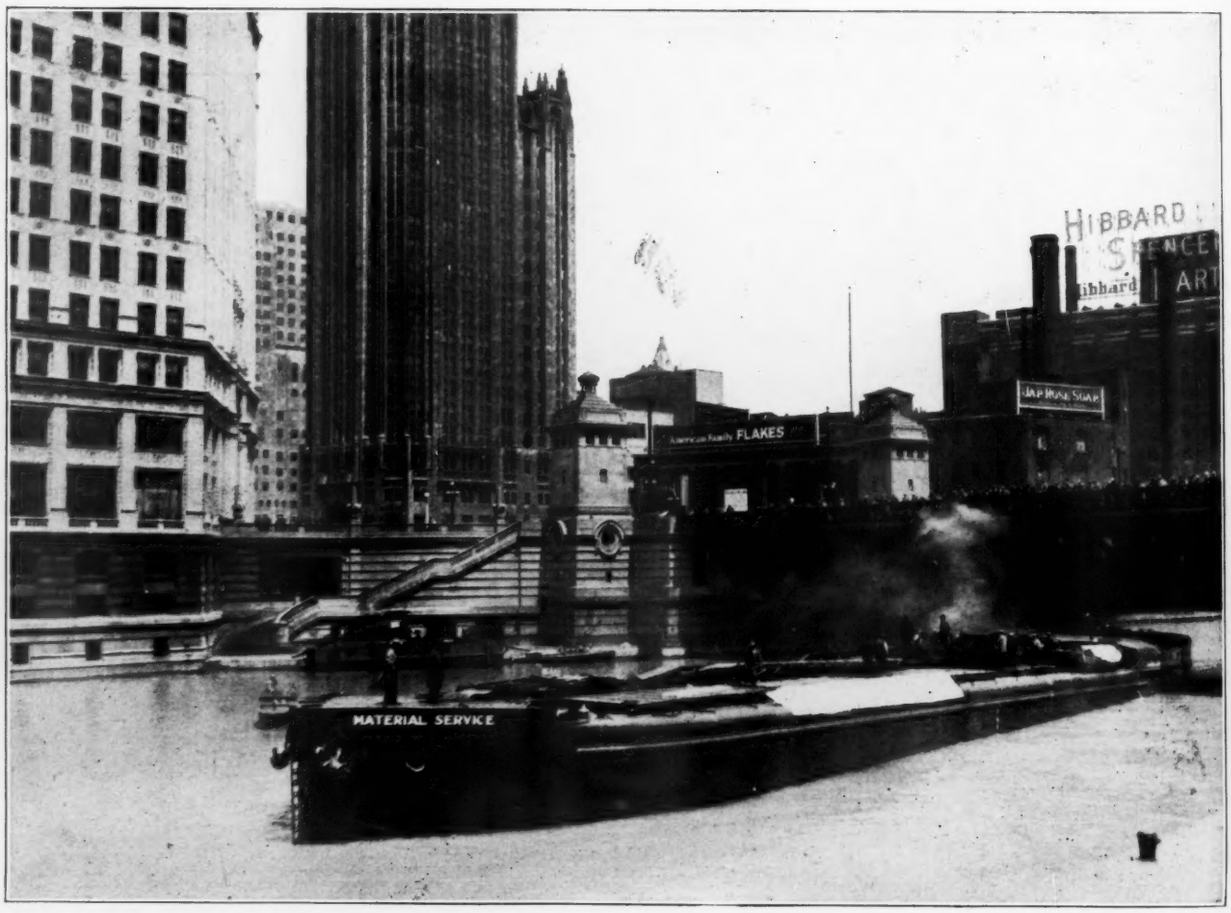
Shuttle Conveyor Loading Gravel Into the "Material Service" at Lockport

Superintendent F. W. Herkel Standing Alongside One of Sand Wash Boxes on Top of Screening Building

a Northwest crane handling an Owen clamshell bucket load into trucks direct from the stockpiles. The crane also loads material from the stockpile into a 35-yd. capacity Johnson bin with two compartments and two volumetric batchers for loading into concrete batcher trucks.

All of the concrete work at the plant and at the South Side yards was designed by the Maritime Engineering Corporation. This includes the highway tunnel, the abutments and piers for the two railway bridges, all plant and machinery foundations and pits, the material tunnel and stockpile partitions and the dock. The structural steel buildings and machinery layout were designed by the Stephens-Adamson Manufacturing Company, which also furnished all rotary screens, sand boxes, feeders and conveyor rollers. The two long inclined conveyors and the weighing conveyor have Stephens-Adamson gravity take-ups. Ajax-Hewitt gutta-percha conveyor belting and Jones speed reducers are used throughout the entire plant. All electric equipment and motors are Allis-Chalmers except where otherwise mentioned. The concrete construction, steel erection, machinery installation and railroad work was done by the company's own forces under the supervision of Paul Ales, who is general manager of the plant. F. W. Herkel is superintendent. An outdoor substation on the property reduces current from 33,000 to 440 volts for all plant operations.

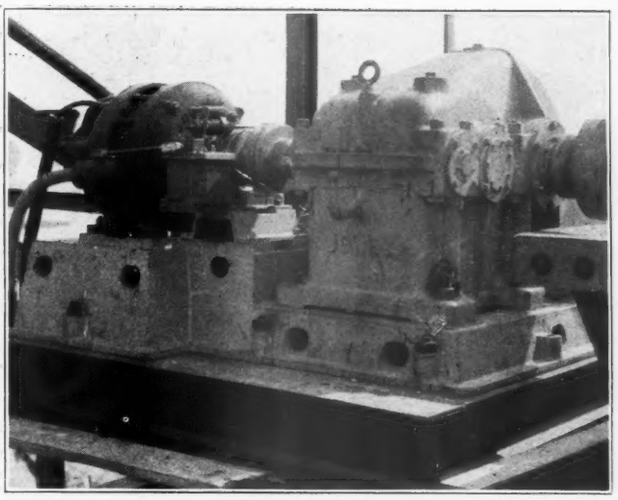
A 24-in. conveyor is being installed which will carry any size of material from the plant to a row of bins now under construction alongside the dock. These bins will have a capacity of about 1,000 cubic yards and will be used for truck loading. An opening in the tunnel under the stockpile allows the installation of a conveyor which will carry the



The Motorship "Material Service" Shown Going Under Michigan Avenue Bridge on Her Maiden Trip. Note Ample Clearance

paving sized material back to the Symons crushers for re-crushing. At present this conveyor is not needed, but it will be installed in the near future in anticipation of the decreased demand for this size of stone in the fall and winter.

Additional live storage capacity for approximately 100,000 cubic yards of material will soon be added to the present 24,000-yd. capacity over the tunnel. A Beaumont scraper system with a 4-yd. bucket and a movable head tower has been purchased and will soon be installed. This storage pile will be in a cleared space just north of the screening and storage building. The intention is to store sufficient material to meet demands during the winter, when cold weather necessitates the shutting down of the plant.



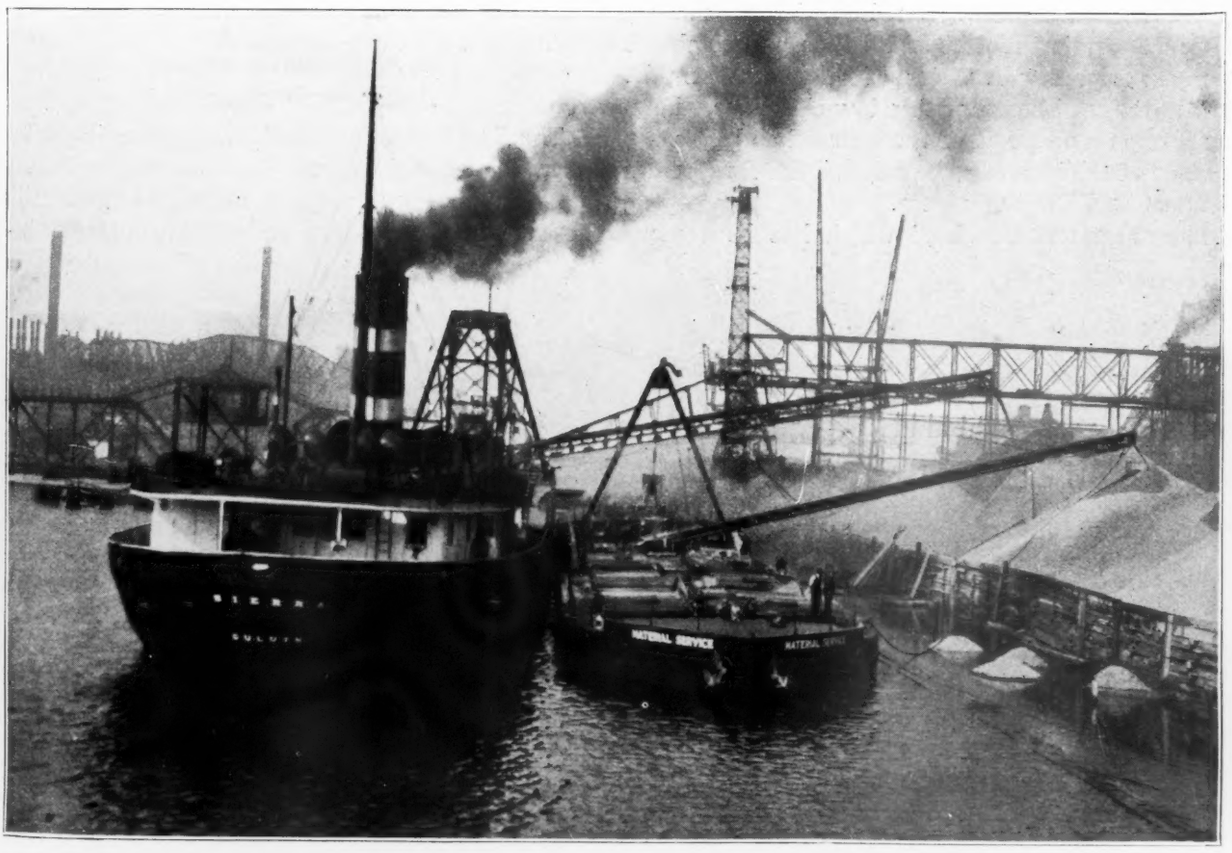
Typical Speed Reducer Drive of one of Belt Conveyors at Plant

The Pump House

Washing water for the plant is supplied by a pump house built on the bank of the Desplaines river a few hundred feet west of the plant. The building is wood-frame with corrugated metal siding and roofing and rests on concrete footings which also serve as the pump foundations. The three pumping units each consist of 8-in. Goulds centrifugal pumps driven by 125-hp. variable speed induction motors. Each unit is rated at 1,750 g.p.m., but the actual output is nearer 2,000 g.p.m. Each pump has Crane check and gate valves. The three 8-in. pipes converge outside of the pump house into a single 15-in. pipe leading to the plant. This pipe was furnished by the American Spiral Pipe Company. Each unit has a Cutler-Hammer controller and Square D safety switch in addition to the main switch. The pumps are primed by an Economy Pumping Machinery Company 2-in. centrifugal pump driven by a 3-hp. Howell electric motor.

The "Material Service"

The motor-ship "Material Service," which carries the material from the Lockport plant to the two Chicago docks, went into service shortly after the plant was opened. The boat was designed and



The "Material Service" Unloading at South Side Yard. The "Sierra" Unloading at Same Time Without Interference

Boom Conveyor on the "Material Service." Motor and Speed Reducer Drive at Right

built by the Leathem D. Smith Dock Company, and was launched at Sturgeon Bay, Wisconsin, on March 6. It is the first of its type and combines the self-unloading features of other Leathem D. Smith designed boats, with a low clearance, allowing it to pass under all of the railroad and highway bridges of the Drainage Canal, and the Desplaines, Calumet and Chicago rivers.

The "Material Service," which has been more completely described in the December 5, 1928, and March 27, 1929, issues of PIT AND QUARRY, has a cargo capacity of 2,500 tons on a 13-ft. draft. The boat is 246 feet long with a 40-ft. beam and will clear bridges of over 14-ft. 6-in. clearance. Two Winton Diesel engines operating twin screws give a loaded speed of 10 mph.

Two 4-yd. Sauerman "Crescent" scrapers in tunnels under the hoppers feed the material to a short belt conveyor, which in turn feeds the 40-in. width, 90-ft. centers boom conveyor. The boom conveyor is driven by a 6-cyl. Wisconsin motor through a Cleveland worm gear speed reducer. The boom is supported from a structural A-frame, which lies flat on the deck when the boat is in motion. A second and smaller A-frame is used to raise and lower the boom A-frame. Superior Iron Works air hoists are used for these operations, air being furnished by a Buhl Type WB 110 portable gasoline driven air compressor. A water ballast tank with a capacity of 1,000 tons allows the boat to submerge while discharging cargo to such a depth that the highest point of the boat remains at less than 12 feet above water level. The water ballast is taken on while discharging and pumped out while loading cargo, avoiding any delay through these operations.

Round trips are now being made between Lockport and Chicago in 24 hours, and this time will soon be reduced to 20 hours or less. Loading at the plant is at the rate of 800 tons per hour and unloading at the yards is done in from 5 to 6 hours.

The New South Side Dock And Distributing Yard

The South Side dock and distributing yard is at 92nd Street and Ewing Avenue on the Calumet river. Delivery is entirely by truck. Everything here is of the same modern type of construction as

View of New South Side Yards from Southwest. Truck in Foreground Approaching Tunnel Entrance

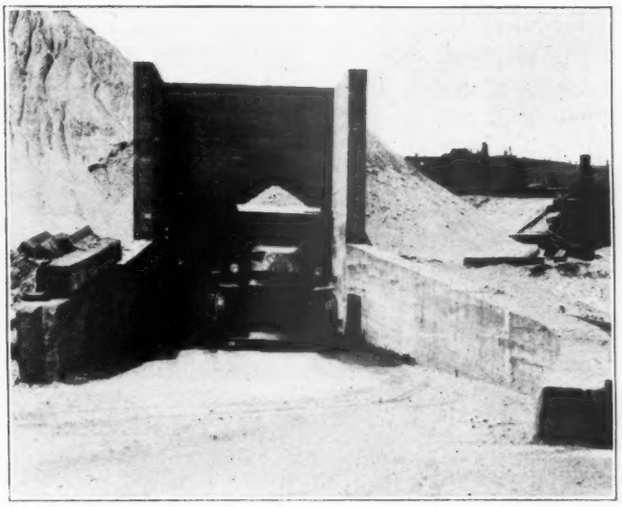
the plant at Lockport. The dock frontage is 646 feet and the property consists of about 7 acres.

A concrete tunnel 450 feet long, 13 feet 6 inches wide and 12 feet high runs parallel to the dock and 70 feet distant. A concrete wall 20 feet from the dock and 13 feet above water level acts as a retaining wall for the stockpiles over the tunnel. Two retaining walls 120 feet apart and at equal distances from each end of the tunnel separate the various sizes of materials stored. These walls are each 35 feet high and 48 feet wide. Retaining walls at the two portals of the tunnel are each 28 feet wide and 26 feet high. A ventilation duct 6 feet wide by 4 feet high runs parallel to the tunnel. It discharges through an outlet on top of one of the retaining walls. Draft is furnished by a Clarage centrifugal fan driven by a 7½-hp. motor with a capacity of 2,500 cubic feet per minute. A Yeoman bilge pump keeps the tunnel dry.

The boat Material Service ties up at the dock and unloads directly onto the stockpiles from the boom conveyor. Shifting to the various stockpiles for the different sizes of material is done by means of shore lines controlled by hoists on the boat. Material discharges into trucks in the tunnel through 45 clamshell gates in the top of the tunnel. These gates and the tunnel gates at the Lockport plant were specially built by the Aetna Engineering Works and can load a 5-ton truck in 15 seconds.

The storage capacity over this tunnel is 50,000 yards, of which approximately 50 per cent can be recovered through the tunnel. A system will soon be installed which will give additional live storage and will make possible the recovery of all the material through the tunnel.

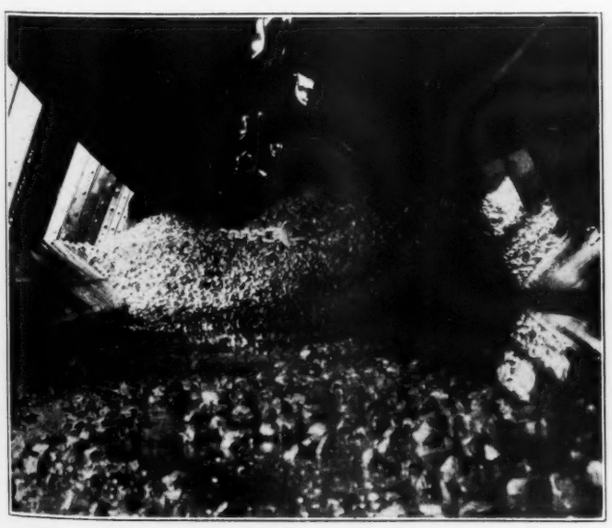
Traffic is one-way, the trucks coming in one side of the yard and entering the tunnel through the south ramp and leaving from the north. A concrete roadway leads to the office where the trucks are weighed on two Columbia beam scales with a capacity of 30 tons each. Trucks are sent out as fast as two shipping clerks can weigh them on the two scales and make out the tickets. The office building is a new two-story brick and concrete structure with the yard offices and store-rooms on the first floor. The yard superintendent, Ed Gorss maintains his living quarters on the second floor. There is also a large brick and concrete cement storehouse on the property. Switchtracks from the E. J. and E. and Short Line railroads have a capacity for 40 cars for the balance of a full line of material and supplies handled at the yard.



Loaded Truck Coming Up Ramp Out of Tunnel at South Side Plant

The North Side Dock and Yard

The North Side yard at Halsted Street and the North Branch of the Chicago river is also served by the "Material Service." The boat unloads into stockpiles from which the material is rehandled into bins by two locomotive cranes. Trucks load



One of the Two Scrapers in the Hold of the "Material Service"

A Truck Load of Cement in Front of the Office Building at the South Side Yards

under these bins for distribution to the Loop and the near North Side. This yard has a stockpile capacity of about 50,000 yards and can ship out 3,000 yards per day with present facilities.

Officers, Etc.

In addition to the operations above, the Material Service Corporation has eight distributing yards in the Chicago district which are supplied with material by rail from other plants owned by the company. The Material Service Corporation also owns and operates the Peoples Crushed Stone Company at LaGrange, with a capacity of 1,500 yards per day, the Carpenterville, Ill., sand and gravel plant with a 2,500-yd. daily capacity, and the Ottawa Sands Corporation silica sand plant at Ottawa with a capacity of 2,000 tons per day. The latter plant went into operation late last fall. In addition to the above plants the Material Service Corporation is taking the outputs of a number of other plants in this district. Officers of the Material Service Corporation are: Henry Crown, president and general manager; Irving Crown, treasurer and vice-president in charge of operation; and Geo. W. Lenzie, general superintendent.

Cement Company Holds Successful Safety Rally

The operating officials, foremen and employees of Superior Portland Cement, Incorporated, held a big safety rally on the school playfield in Concrete, Washington, the afternoon of May 28, to help raise enthusiasm for the annual June no-accident campaign. Practically every employee of the company was there and many of them brought their families.

The program started about 4 o'clock and was opened by a number of selections by the Mt. Shuksan band, being the first public appearance of the band in that city since the new uniforms arrived. The boys provided some splendid music, which was greatly enjoyed by the crowd. H. A. Ambler presided, as chairman of the rally, and after a short talk, explaining the purposes of the rally, introduced G. J. McGlinn, assistant supervisor of safety in the state department of labor and industries, who was the speaker for the afternoon. Mr. McGlinn outlined the history of the safety movement, and told how the results of the safety campaigns were shown on the records of the state department. He compared the splendid work of the cement plants in reducing accidents with the lack of progress in other hazardous industries in the state. He also showed the value of safety work to the employee and to the community, and congratulated the men of the Superior plant on its splendid record. His address was enlivened by a number of entertaining stories. James H. Kane of Seattle, who was also scheduled for a talk, was unable to come to Concrete on account of business affairs. The rally closed with more music by the band.

The drive is sponsored by the Portland Cement Association for the elimination of all accidents during the month of June in every member mill of the association. National and state departments of labor, as well as all national and local safety organizations, are assisting.

C. N. Reitze, vice president of the company, said, "Every man in the organization is behind the move. We confidently expect to surpass all previous records and establish the Superior plant in the front rank of all mills of the country, from the standpoint of safety."

A safety flag, presented by the association, was unfurled June 1. It will fly as long as the plant continues to operate without a lost-time accident.

New Castle Has Regional Safety Meeting

Executives and safety engineers of the district met in New Castle, Pennsylvania, on June 18 to study plans for prosecuting the safety movement. The meeting was called to order at 10:30 a. m. by W. P. Rice of the Crescent Portland Cement Company, and the first address was by W. E. Darling, who was followed by Dr. Lindley with a discussion on eye injuries. "How to Win an Association Trophy" was discusseed by F. C. Brownstead of the Alpha, Ironton, Ohio; Eric J. Ochs of the Standard, Painesville, Ohio, and W. L. Matthes of the Alpha, Manheim, West Virginia. This was followed by a luncheon with A. J. Eales, safety director, Bessemer Cement Corporation, as chairman. Among the speakers at the luncheon were F. Rontz of the *New Castle News*, and L. Rounds of the Penn Power Company.

"Executive's View on Safety" was discussed by J. B. John and Wesley Davy. The Safety Meeting Dialogue was given by Voss and Grady, Alloy Steel Company, and a First-Aid Demonstration was given by teams from Bessemer-West Penn, Universal Portland Cement Company. The Round Table discussion was led by A. J. R. Curtis of the Portland Cement Association, and E. D. Barry of Universal was toastmaster at the evening banquet.

The New Castle Committee consists of J. R. Rice, W. Kleckner, J. B. York, J. R. Kline, A. J. Eales and A. C. Toner.

Improved Use of the Wire Saw in Slate Quarrying

By OLIVER BOWLES*

THE wire saw, introduced by the Bureau of Mines about two years ago, has revolutionized slate quarrying in Pennsylvania. The success of the saw since its early accomplishments has become greater and greater as the equipment has been perfected and skill acquired in its use. In the first test made, a cutting rate of 9.7 square feet per hour was attained; in the next four cuts, made early in 1927, the average rate of cutting was increased to 12.8 square feet per hour; in 1928 a maximum of 34 square feet per hour had been attained, with a general average of about 20 to 25 square feet. The wire saw is now regarded as essential equipment in practically all of the quarries in the Bangor, Pen Argyl, and Windgap districts.

The wire saw consists of a three-strand steel cable of 3/16- or ¼-inch diameter running as an endless belt. The driving pulley is a 40-inch double-groove cast-iron sheave. A tension pulley supported by a frame mounted on wheels may travel back and forth on a short track. A weight of 800 to 2,000 pounds gives the desired tension on the wire. The driving units consist of electric motors with direct-drive compactly enclosed gear reduction, or double-belt speed-reduction units; the former is preferred. Silent chain and pinion gear reductions are used to a limited extent. The traveling speed of the wire is about 15 feet per second. The driving and tension equipment is shown in Figure 1.

The equipment in the quarry consists of a pair of standards, each having one or two sheaves at the top for receiving and conducting the wire to a lower sheave which travels up or down by a rope-pull worm gear. The standards are either placed on platforms, over the edges of open benches, or in holes about 10 feet deep and large enough to accommodate the movable sheaves. The standards are usually set up 60 to 100 feet apart. By lowering the guide pulleys, the wire is brought in contact with the slate surface and, when fed with sand and water, makes a cut over the entire distance between the standards. The arrangement of the cutting equipment is shown in Figure 2. The original equipment had guide pulleys which were 26 inches in diameter, but it is now found that sheaves 18 or 20 inches across give satisfactory service. Provision is made for attaching a 14-inch sheave for use in cramped spaces. Other standards with orienting pulleys are required to carry the wire from the driving mechanism to the point where cutting is desired. For deep quarries a long wire may be needed. Wires from 800 to 1,800 or 2,000 feet long are used.

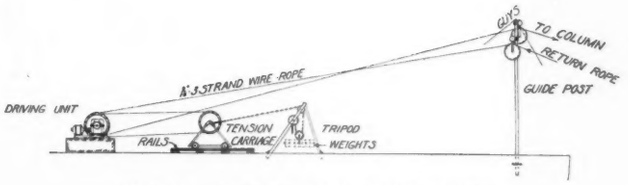


Fig. 1. Driving End of Wire Saw.

The sinking of holes for the standards required a type of equipment entirely new to the slate district. Core drills making holes 36 inches in diameter are now in general use.

The results of preliminary tests made in the Colonial Slate Co. quarry with the able assistance of Sidney Spry, president of the company, were given in a paper entitled "The Wire Saw in Slate Quarrying, Preliminary Report," Serial 2820, issued by the Bureau of Mines in July, 1927. The results obtained in practical use of the equipment by two other companies (Chapman Slate Co. and Jackson Bangor Slate Co.) were described in a supplementary report, Serial 2851, dated January, 1928. Since the appearance of these two reports much progress has been made, and the present paper is designed to cover the results attained during the summer of 1928.

Equipment in Use October, 1928

The widespread popular acceptance of the wire saw and the phenomenal growth in its use are noteworthy. Late in 1927, when the second report was prepared, three companies each had one wire saw, and two core drills were in use. In October, 1928, the following equipment was noted in the Pennsylvania slate district:

Wire Saw Equipment in Pennsylvania in October, 1928

Company	Wire Saws	Core Drills
Colonial Slate Co.	2	1
Imperial Slate Blackboard Co.	1	
Phoenix Slate Co.	2	1
Keenan Structural Slate Co.	2	1
Stephens-Jackson Co.	2	1
North Bangor Slate Co.	1	
Columbia Bangor Slate Co.	1	
Jackson Bangor Slate Co.	3	1
Belmont Slate Co.	1	
Bangor Fidelity Slate Co.	1	
Parsons Bros. Slate Co.	2	1
Diamond Slate Co.	1	
Doney Slate Co.	1	1
Slate Products Co.	1	1
Bangorvein Slate Co.	1	1
Chapman Slate Co.	2	1
American Slate Quarry	1	
Albion Vein Slate Co.	2	
	27	11

Another preventive measure is to avoid, if possible, making a cut intersecting an open seam at a long angle, for V-shaped masses at the intersection

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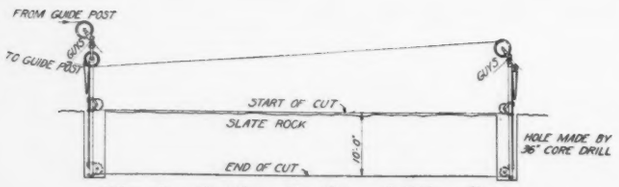


Fig. 2. Cutting Section of Wire Saw.

of the wire cut and the seam are inclined to break loose and jam the wire. Wedging would probably fail to prevent such an occurrence.

Several companies have stated that a closely twisted wire is preferable for cutting, as it holds and carries the sand more effectively and therefore cuts faster than wire wound at a long angle. Another objection to the wire wound with a long twist is the danger that the splices will pull out. As the wire operates under a heavy tension, the splices must be strong; closely twisted wire provides sufficient friction between the strands to withstand the tension.

Two standard sizes of wire are in use, 3/16 and ¼ inch. There is some difference of opinion as to which is the best. Some operators believe that if there is any probability that a wire will be worn out before a cut is finished, it is best to begin with a ¼-inch wire, as it would be easy to follow with a new 3/16-inch wire. According to others, this precaution is unnecessary, for even a greatly worn 3/16-inch wire makes a cut sufficiently larger than its diameter to permit the entrance of a new wire.

Difficulty is commonly experienced in placing a new wire in a partly completed cut. When introducing it from the top of the cut the irregularities of the surface will cause it to bind unless the wire is oriented in a position exactly parallel with the direction of the wire when the cut was made. It is almost impossible to maintain this parallelism, and therefore it is better to splice the new wire to the old, and draw it through the cut.

Operating Suggestions

In operating a wire saw the wire should not be forced down too rapidly. Some operators use a steel gauge to measure the depth of the cut near the center, and the downward movement of the guide pulleys is governed by the rate of progress at the center.

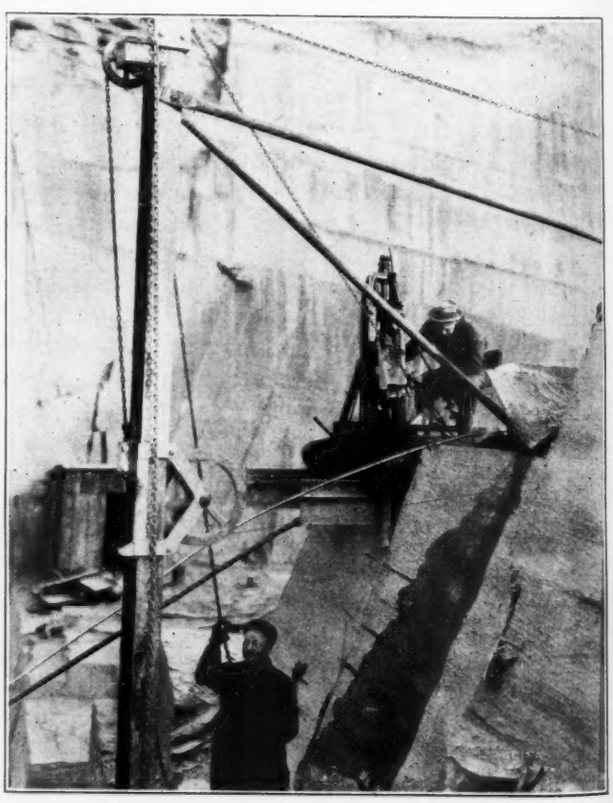
It is highly important that the center be cut down to approximately the same level as the ends. This may require that the wire be kept running for some hours after the ends of the cut are finished. For very long cuts it is customary in some quarries to put down center holes in which center standards are placed midway between the end standards. The center standards are provided with movable sheaves actuated by worm gears similar to those of the end standards, so that the wire may be forced downward at the center as well as at the ends.

The grade of sand best suited for wire-saw work has not yet been definitely determined. The sand, however, should be free from pebbles, and of such a size that the grains will carry well and provide effective cutting surfaces. A crushed quartz running 100 per cent through 20 mesh and 95 per cent on 70 mesh is now widely used. At present study is being made of the quality and grain size of sand that will give the most efficient service.

When a cut is completed the lower guide pulley is usually at the bottom of the standard, but before starting a new cut it must be elevated to a point near the top of the standard. This procedure involves winding back the slow-motion worm gear and requires much time and labor. An improvement has been developed in the construction of the standards whereby the gear shaft is made to project in the construction of the standards whereby the gear shaft is made to project so that an air-driven mechanical rotator may be attached to its square end. This permits rapid winding, and the use of compressed air saves a great deal of hard manual labor.

Careful records of results accomplished with channeling machines in a large slate quarry at Pen Argyl, Pa., showed that the total square feet cut by four channeling machines over a period of five months was 13,729 square feet; reduced to a basis of actual working time as shown on the men's time cards, this indicated an average of 31 square feet per day for each machine.

Two slate companies kept detailed records of work accomplished with the wire saw, and their re-



Detail of Standard for Wire Sawing.

ports are summarized as follows: Two wire saws were used in one quarry, and a record was kept for 20 days, during which time three men were constantly employed either in operating or in setting up equipment; during the period seven cuts were made and one core hole 14 feet deep was drilled; the total surface area cut was 6,060 square feet, an average of 303 square feet per day for the two saws, or 151.5 square feet per day for each saw.

Another company kept a record for 14 wire-saw cuts, totalling 9,650 square feet. The running time, exclusive of setting up, but including all stops and delays from various causes incident to the work, was 623.5 hours. During this period one man was employed continually. An additional man was employed in setting up the equipment for each cut. This required 70 hours' additional time. The total time reduced to a 9-hour day basis would be 77 days, and the average cutting rate would be 125.3 square feet per day.

The above figures indicate that in a given period of time the wire saw will cut four to five times as much as a channeling machine.

Thus the number of wire saws increased from 3 to 27 in about a year.

Sinking Standard Holes

The difficulty of sinking 36-inch holes for the standards has been successfully overcome through the development by a machinery company of a rotary drill that has given excellent service. Steel shot is used as abrasive. The cutting drum is 30 inches high, so that each 30-inch section of the core must be removed to make way for further cutting. A rate of 30 inches in 50 minutes' actual cutting time has been attained.

The process of removing a core section as employed by one of the companies first using the drill was as follows: The cutting drum was raised from the hole and set to one side. A jack-hammer hole was drilled 30 inches deep in the center of the core. About a pint of black blasting powder was poured into the hole, tamped with slate dust, and fired by fuse; the shock split the core free at the bottom. This was easily accomplished, as the slaty cleavage dips 10 to 15 degrees from the horizontal. Another hole was then drilled a few inches deep, a little to one side of the first, and a split key with an eye at the top was driven down. A wedge was placed in the split, and when it reached the bottom of the hole, further driving caused it to spread the key, and thus hold it securely in place. The block could then be hoisted out by placing the hook of the hoist cable in the eye of the split key.

In the late summer of 1928 an improved method of removing the cores was worked out. Before commencing work with the core drill a jack-hammer hole was drilled in the center of the mass to be removed to the full depth of the core drill hole,

Showing Mechanical Details of Wire Sawing.

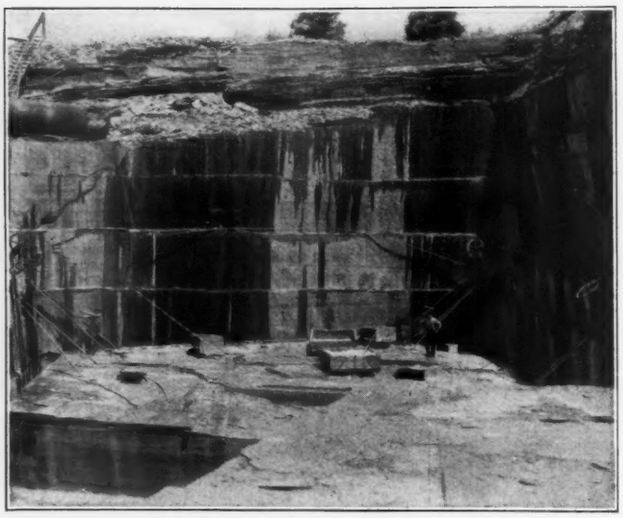
usually about 10 feet. When the first 30-inch core was drilled and the cutting drum removed, a wedge was driven into the cut. The force of the wedge split the core loose on the slaty cleavage, which is nearly horizontal in many of the quarries. At the same time it shifted the block a little to one side, and when the split key was driven into the hammer-drill hole previously made, the hole was sufficiently offset at the break for the wedge to encounter the upper surface of the unbroken core at one side of the hole; thus with further driving the wedge spread the split key and permitted the block to be removed with the hoist. The one hammer-drill hole served for all the cores, and the necessity for drilling each one separately was avoided. The wedging method is better than drilling and blasting, though the latter method may be necessary in rock that splits with difficulty.

The core-drill holes are commonly sunk in hard ends, or intersecting ribbons or seams, and thus the material in the cores is usually of inferior quality. Cores of good rock may, however, be used for roofing-slate manufacture.

The first 10-foot hole put down in one Pen Argyl quarry required four days' work, including time of set-up. The second hole required three days, and the third two days. This indicates the time efficiency that may be attained through increased familiarity with the equipment. The sinking of a 10-foot hole in one day or a little more is now not uncommon.

The holes may be made vertical or may be inclined at any angle up to 45 degrees, though the cutting is slower in inclined holes. Very often the holes are inclined to follow the direction of the ribbon in order that the standards may be similarly inclined to make the cut parallel with the ribbon and thus avoid waste.

In one corner of their quarry Parsons Bros. Slate Co. sunk a hole at an angle of about 70 degrees to a depth of over 40 feet. This was an interesting



Wire-Sawing Equipment at Face of a Slate Quarry.

accomplishment in that it indicates the feasibility of reasonably deep drilling with the core drill.

A channeling-machine cut has been used in one quarry in the place of a core-drill hole. A short 6-inch channel cut is made parallel with the direction in which the wire is to run. The standard is set over it, and a piece of railroad rail clamped to the standard projects downward into the cut. The movable pulley frame slides on the rail and thus guides the downward course of the wire. Fairly satisfactory results have been obtained, but the equipment lacks rigidity when the wire operates under heavy tension.

Some difficulty has been caused by the closing of the rock on the wire. The rock may be under compressive stress so that when the cut provides a means of relief, the rock expands and closes the cut. This is most likely to occur in a sink cut—that is, the original cut in a new floor—for when a trench is once cut the pressure is relieved by expansion. Movement as a result of relief from compressive stress is usually gradual, and if the wire is kept constantly at work no interruption may occur; if work is suspended during the night, however, it may be impossible to start the wire in the morning. On this account it is customary in several quarries to keep the wire running night and day until a cut is completed.

The movement of the rock may be abrupt and may stop the wire suddenly. The movement may not be caused by rock expansion but simply by the slipping of a rock mass. Open seams designated as loose ribbons may permit such movement.

The pinching of a wire almost invariably results in cessation of work in the particular cut involved, for a wire once caught by rock movement can rarely be started again. If the cut has already been carried downward several feet, the rock mass may be removed in the course of quarrying to the bottom of the cut, and thereafter a new cut be made to the desired depth. If a cut must be abandoned a short time after it is started, a new cut is begun a few inches to one side of the original.

Obviously, every precaution should be taken to prevent pinching of the wire. Some operators drill holes at intervals along the cut and drive plug and feather wedges in them. This will prevent a mass of rock from sliding against the wire.

One company that formerly used seven channeling machines has placed all the machines on the quarry bank, and three wire saws have been substituted for them. In October, 1928, the quarries were in unusually good condition, for so many cuts had been made that very little further cutting was needed to provide rock for the winter months. It is stated that when channeling machines were used, it was never possible to have cutting completed so far ahead of block removal.

Use of the Wire Saw in Slate Mills

The unqualified success of the wire saw in slate quarries suggests an extension of its use in slate-finishing mills. In mills where circular saws are now employed the blocks might be lined up in such a way that many of them could be cut at one time with a wire. Such a process is not new. The wire saw has been used for many years at marble yards. Ten to 20 blocks are lined up and a wire is used to scabble or square them up by slabbing off the irregular surfaces. The equipment would be much simpler and less expensive than circular saws.

Résumé of Construction Projects in Canada

Construction work planned in Canada, as reported by Assistant Trade Commissioner L. A. France, Montreal, include the following projects: A $250,000 linen plant and a $3,000,000 bridge, Vancouver, British Columbia; a $175,000 showroom and garage building, a $400,000 ramp garage, a $175,000 office building, and a $180,000 apartment house, Toronto; a $1,000,000 sulphite plant, Edmundston, New Brunswick; a $1,000,000 gas manufacturing plant, a $200,000 apartment house, and a $200,000 elevator addition, Moose Jaw, Saskatchewan; a $225,000 apartment house, and a $500,000 municipal incinerator, Montreal; a $175,000 post office, Niagara Falls, Ontario; a $300,000 engine house, Sudbury, Ontario; a $400,000 filtration plant, Brantford, Ontario; a $6,000,000 power development scheme, Musquash River, Ontario; and a $15,000,000 power-development scheme, High Falls, Ontario.

School building projects in various sections of Canada, as reported by Assistant Trade Commissioner L. A. France, Montreal, include the following: A $300,000 vocational school and a $100,000 high school, Ottawa; a $160,000 public school, Sandwich, Ontario; a $132,000 technical school, Sault Ste. Marie, Ontario.

Physical Qualities of Slag

THE National Slag Association of Cleveland, Ohio, has published Symposium No. 14 of a series describing the characteristics and uses of blast furnace slag. This symposium, entitled "Physical Qualities of Slag," describes those physical qualities not treated in previous issues. These include: Color, Odor, Toughness, Hardness, Percussion, Specific Gravity, Voids, Bulking, Compression, Weight per Cubic Foot, Cleanliness, Freedom from Organic Matter, Uniformity, Melting Point and Temperature of Molten Slag. The characteristics described in previous symposiums are: Absorption and Moisture, Resistance to Abrasion, Thermo-Conductivity, Resistance to Fire, Bond, Surface Area, Texture, Solubility, Fracture, Shape and Density.

Color of Slag

A number of articles and papers are cited in which reference has been made to the color of air-cooled blast furnace slag. Sanford E. Thompson, consulting engineer of Boston, Massachusetts, in a paper, "Slag as a Concrete Aggregate," presented in 1917 before the American Concrete Institute, perhaps gives the clearest definition. He says that limestone slag has a distinct bluish or sometimes greenish tint when fresh and changes to a much whiter color after a few months' exposure. This change is due to the oxidation of sulphide to sulphates. Slag made from a dolomite flux is a dark gray in color.

Odor of Slag

Several authorities are also quoted to the effect that hardened slag concrete has no perceptible odor. Dr. A. Guttman, director of research, Eisen Portland Cement Association, Dusseldorf, Germany, in "Use of Slag in the Building Industry," makes the following statement: "The calcium sulphide content of blast furnace slag reveals itself in granulation by a smell of sulphuretted hydrogen. When highly basic slag sand (granulated) rich in calcium sulphide is used in making mortar or concrete, this odor is perceptible even during the hardening, but it is found to vanish as soon as the building materials have become hard so that no further decomposion of the calcium sulphide through the elements of the atmosphere can take place."

Cleanliness of Slag

The symposium states that one of the most desirable features of slag, from the standpoint of the engineer, is its cleanness and freedom from any organic matter, such as roots, grass, dirt, leaves, etc. The processing through which it passes in the blast furnace removes all possibility of organic matter surviving and becoming incorporated in concrete, and the screening operations remove most of the dust of fracture from the individual pieces, leaving them clean and capable of providing the greatest possible bond with either portland cement or bitumen.

In support of the above statement, a number of authorities are quoted. C. S. Hill, associate editor of *Engineering News Record*, in an article, "Slag Concrete Roads—Their Construction and Wear," published in that magazine September 14, 1922, says: "Compared with stone or gravel, slag is a clean and dustless material to handle."

Melting Point and Temperature

There is some doubt as to the actual melting point of slag but the actual figure is somewhere between 2100 deg. and 2600 deg. F. G. A. Rankin and F. E. Wright have conducted extensive experiments at the U. S. Bureau of Mines which show that the melting point of blast furnace slag ranges from 2138 to 2606 deg. F., according to its composition. Tracy Bartholomew, Senior Industrial Fellow, Mellon Institute, Pittsburgh, Pennsylvania, in researches recently made there, found that slag is solid at 2100 deg. F., viscous at 2200 deg., and fluid between 2300 deg. and 2600 deg. F.

Uniformity of Slag

The symposium states that in practically any large volume of commercial slag, there will be found some pieces more dense than others. This is said to be due to the variable amount of gases contained by the molten slag in the furnace, and later given off on cooling. Since the true specific gravity of slag varies but little, the size and number of these gas bubbles or pits determine largely the weight of the material after it has cooled. However, since the cells formed by gases are generally non-communicating, no bad effects of such variation in density are to be anticipated. Tests have shown that very light slag gives substantially the same compressive strength in concrete as the denser material and accelerated durability and soundness tests have shown no difference between them.

Specific Gravity

The specific gravity of blast furnace slag may mean the "apparent" specific gravity which does not take into account the cells in the slag, and the "true" specific gravity of the actual solid material. The former of these two is most commonly used. From a large number of tests made in laboratories both in this country and in Europe it was determined that the apparent specific gravity of blast furnace slag is usually between 2.10 and 2.25, although individual results as high as 3.22 and as low as 0.87 have been obtained.

The apparent and true specific gravity of granulated slag vary greatly due to its porous struc-

ture. Dr. J. E. Stead, metallurgical chemist, of Middlesbrough, England, in an article, "Blast Furnace Slag in Concrete and Reinforced Concrete," published in *Engineering World,* February and March, 1919, says that the apparent specific gravity was only 0.50 while the true specific gravity obtained by pulverizing the grains was 2.87.

Weight Per Cubic Foot Of Slag and Slag Concrete

Since the weight per cubic foot of slag is the requirement most commonly met with in specifications, the weight of this material as commercially produced is of great importance. Most specifications call for a weight of at least 70 lb. per cu. ft. when the slag is in a dry and compact condition. A cubic foot of loose air-cooled slag may weigh only 68 lb. while the same amount of compacted slag will weigh as much as 10 lb. more. Graduation also has an effect as a cubic foot (compact) of one-size material may weigh from 5 to 10 lbs. less than an evenly graded sample. Numerous authorities are quoted to this effect.

Professor Duff Abrams, then professor in charge of structural materials research laboratory, Lewis Institute, Chicago, in an article, "Wear Tests of Concrete," also published as Bulletin 10 of the laboratory in December, 1921, gives some typical test results. Twenty-one slags, covering most of the slag-producing districts, were tested. These were made on dry rodded material sized ¼-in. to 1½-in. and averaged 88 lb. per cu. ft. with a range of from 66 lb. to 96 lb.

Experimental and special slags have been made weighing as little as 30 lb. per cu. ft. and as much as 105 lb. per cu. ft. These of course are dry rodded material and are not representative of the regular commercial slags. Water-cooled (granulated) slag test results are also given which show an average weight of about 50 to 55 lb. per cu. ft.

Slag concrete is found to vary from 127 to 50 lb. per cu. ft. according to the mix and the weight of the slag aggregate used. The figure of 135 lb. per cu. ft. may be taken as average for the intermediate mixes (1-2-3, 1-2½-4, etc.) when a medium-weight slag (70-80 lb. per cu. ft. dry compact measure) is used as the coarse aggregate.

Voids in Slag

A most comprehensive series of void tests were recently carried out under the direction of Fred Hubbard, consulting engineer of the Standard Slag Company at the company's laboratory at Youngstown, Ohio. Slags from 44 sources in Ohio, Pennsylvania, Maryland, New York and Kentucky were tested, the voids being computed from the specific gravity and unit weight. The water displacement method was also used. Results from these tests and others quoted in the symposium show that air-cooled blast furnace slag in the concrete aggregate sizes average about 41 per cent voids when the determination is made on a compact sample.

Bulking of Slag

The bulking of coarse aggregates from moisture content is negligible and this is also true of slag. There is, however, a mechanical bulking, due to the material arching up when in a loose condition, and settling down when compacted. Various tests made on this bulking give results varying from 8.6 per cent to 14.9 per cent, this variation being largely due to the difference of gradation in the materials tested.

Toughness of Slag and Its Resistance to Percussion

The standard test for toughness of aggregate consists of submitting a cylinder of material to the blows of a 2 kgm. hammer falling from increasing heights, starting with 1 cm. and increasing 1 cm. at each blow. The height (in cms.) at which failure occurs is the toughness factor. Several other methods of testing used in Europe are also referred to and typical results given. The results of these tests show that slag itself falls a little below the toughest rocks.

Similar tests were also made with slag as an aggregate in bituminous concrete and in concrete. These tests, made under the supervision of numerous authorities on pavement and concrete, show that slag when incorporated in a structure with either bituminous or portland cement produces a mixture equalling and sometimes exceeding in toughness similar mixtures with much tougher rocks.

Hardness of Slag

The hardness of an aggregate is quite as important as its toughness when used for some purposes such as in waterbound macadam road construction. The use of this type of pavement, however, is now diminishing and this test for slag is no longer specified by any State Highway Department. Slag when incorporated with cement (either bituminous or hydraulic) shows equal or superior qualities to similar mixtures made with harder aggregates. The results of tests quoted in the symposium show that the hardness of slag by itself is equal to the average natural rock and is only a little less than that of the hardest.

Crushing Resistance

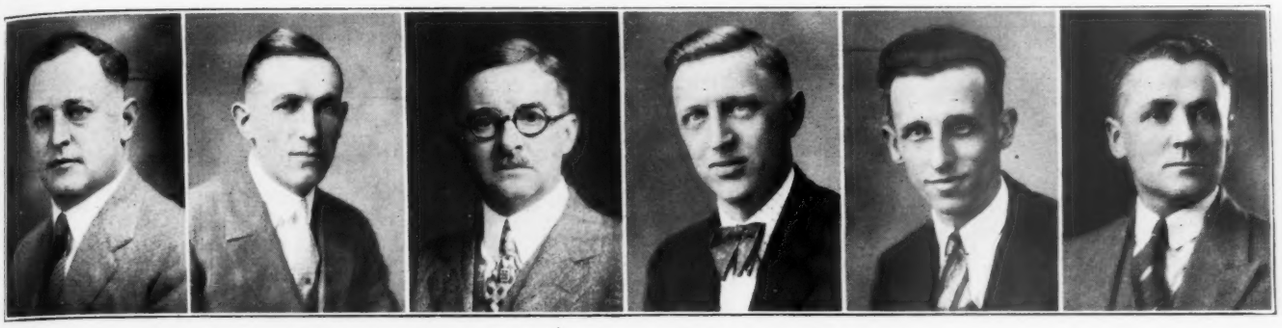
There is very little existing data on the crushing strength of solid slag but results of tests available show that it is well above that of the best concrete. Several results are given on tests made in this country and in Europe on many different types of slag. The test results gave solid slag a crushing resistance averaging between 30,000 and 35,000 lb. per sq. in. The lowest result was 9,000 lb. and the highest 41,856 lb. per sq. in.

Alton A. Weigel and Associates Form New Corporation

THE interests of Valentine Arnold in the former partnership of Arnold and Weigel, contractors and engineers, Woodville, Ohio, have been purchased by Alton A. Weigel and associates. A new corporation, organized and incorporated under the laws of the state of Ohio, will be known as Arnold and Weigel, Incorporated. The new organization has brought together a competent personnel of exceptional and practical ability, men whose knowledge of engineering, construction, research, processing, consulting and chemistry, is exceptionally developed.

The new organization will continue with the same types of equipment as the former Arnold and Weigel partnership, featuring the Arnold vertical kiln, the Ward automatic coal feeders for externally fired lime kilns, A & W pneumatic draw shears, the large and small type Weber batch-type lime hydrators, and the McGinty shaking grates.

This company owns and operates its own experimental plant, especially equipped for industrial developments. The plant is unique in the fact that it is equipped with reduced size apparatus, capable of producing manufacturing conditions and products in exactly the same manner as a full sized plant would produce in commercial operation. It has thus been possible to study raw materials and finished products, preliminary to final construction of new plants, especially in the development of new fields. A new laboratory has been established for chemical and physical control work. The personnel of the new company is as follows: A. A. Weigel, president and general manager; H. W. Hess, vice-president and consulting chemical engineer; R. H. Sandwisch, secretary-treasurer; A. J. Henkey, chief engineer; H. J. Pinder, assistant chief engineer, and R. B. Eversole, field engineer.



Staff of Arnold and Weigle, Incorporated:
Reading Left to Right, A. A. Weigel, R. H. Sandwisch, H. W. Hess, A. J. Henkey, J. J. Pinder, R. B. Eversole

H. M. Hadley Named Western Regional Structural Engineer For Portland Cement Assn.

As the first step in an enlarged structural program, the Portland Cement Association announces the appointment of Homer M. Hadley as regional structural engineer for the Pacific Coast. He is to act in an advisory capacity to architects and engineers for the territory of California, Nevada, Arizona, Oregon, Washington and British Columbia.

For the last seven years Mr. Hadley has been in the employ of the association, first as field engineer and then as district engineer with offices in Seattle. He brings to his new post a structural experience both wide and varied.

Mr. Hadley, who has been an associate member of the American Society of Civil Engineers for 22 years and former president of the Seattle chapter, is regarded as one of the outstanding engineers in concrete structural design of the Pacific Coast. He is a member of the American Concrete Institute and Engineers Club, Seattle. In his new appointment, effective immediately, he will maintain offices in Seattle.

Cement Industry Demands Some Tariff Protection

Cement is one of the products about whose tariff protection considerable discussion has been had in Washington during the special session and in which there is considerable interest. The cement industry has contended that it should have protection against foreign importation of cement for the fact that, for instance, cement plant labor in Belgium draws a dollar a day while the wages in this country average around four dollars a day. Cement, as ballast for returning steamships comes by such cheap ocean freight that it can be laid down on the Atlantic seaboard at a cheaper freight rate from Belgium ports than it can be hauled by rail a short distance in this country.

There has been some opposition to the proposal to protect cement, it now has no tariff protection, by reason of the fact that this session of congress was called for farm relief and the farmer is said to be arguing that he can find no relief in legislation which promises to increase his building costs.

The cement industry contends that there will be no increase in price by reason of the tariff. The argument of the cement industry is that without the tariff the plants on the Atlantic seaboard will be closed down through inability to contend with the foreign product of cheap labor and cheap water rates. In that event, these plants must come inland and fight for a market under conditions which would mean the closing of inland plants and a serious loss to an industry representing a large employment roll. If the seaboard plants surrender to existing conditions and close in the face of competition from a cheap-wage foreign product, brought in under cheap water rates, the supply of cement now manufactured in the interior will be in part drawn into the border zones now supplied by the seaboard plants. This will increase interior rates on cement and retard building operations.

This, in general, is the statement of the case as presented by the cement interests of the interior in their advocacy of a tariff on cement, in the pending revisions.

Distribution of Cement

The following figures show shipments from Portland cement mills distributed among the States to which cement was shipped during March and April, 1928 and 1929.

Portland cement shipped from mills into States in March and April 1928 and 1929, in barrels

Shipped to—	March		April	
	1928	1929	1928	1929
Alabama	282,379	127,916	233,865	166,925
Alaska	264	525	542	1,778
Arizona	81,586	57,406	64,808	51,150
Arkansas	101,428	93,133	86,513	99,392
California	937,253	1,063,895	1,058,739	973,052
Colorado	60,381	59,854	90,312	99,991
Connecticut	113,752	106,492	187,697	158,919
Delaware	19,230	19,112	26,177	31,219
District of Columbia	62,160	86,492	66,108	97,218
Florida	114,798	100,388	134,647	101,227
Georgia	157,171	95,061	155,787	139,353
Hawaii	39,411	22,366	19,314	24,308
Idaho	23,994	20,842	30,832	26,923
Illinois	700,881	612,069	1,192,251	1,069,018
Indiana	232,338	251,934	355,434	365,104
Iowa	149,705	123,637	405,654	215,629
Kansas	194,957	217,559	202,705	285,944
Kentucky	103,113	102,241	130,168	163,059
Louisiana	115,669	104,285	112,667	105,290
Maine	18,704	19,229	30,015	34,197
Maryland	123,334	131,729	176,807	169,575
Massachusetts	160,730	165,380	256,150	225,829
Michigan	433,110	474,902	710,731	785,443
Minnesota	128,332	136,193	185,901	220,077
Mississippi	73,937	75,353	73,651	76,425
Missouri	333,221	342,697	383,704	405,208
Montana	27,231	20,068	32,676	49,313
Nebraska	88,491	88,438	108,224	106,392
Nevada	7,568	9,755	7,195	10,848
New Hampshire	25,575	32,824	34,667	42,936
New Jersey	505,016	485,067	778,746	689,358
New Mexico	30,606	25,796	27,664	33,100
New York	1,237,218	1,285,742	1,758,888	1,597,182
North Carolina	209,006	159,570	199,340	224,791
North Dakota	18,274	16,912	34,627	62,207
Ohio	540,347	564,820	776,992	849,359
Oklahoma	294,206	318,321	209,850	309,739
Oregon	78,121	80,134	102,480	79,593
Pennsylvania	657,006	715,616	928,060	959,640
Porto Rico	1,329	420	0	975
Rhode Island	47,707	43,300	81,029	65,457
South Carolina	119,612	100,091	101,838	131,517
South Dakota	25,694	32,110	42,599	40,519
Tennessee	174,774	140,815	216,928	231,259
Texas	546,960	621,387	526,063	694,150
Utah	35,955	28,712	36,932	46,663
Vermont	14,737	24,984	27,791	33,851
Virginia	173,697	138,772	175,192	176,266
Washington	162,335	214,280	237,749	255,250
West Virginia	81,273	70,720	103,682	93,098
Wisconsin	148,969	197,738	287,693	352,986
Wyoming	13,571	7,672	15,229	12,491
Unspecified	57,761	29,029	41,738	23,846
	10,084,877	10,063,783	13,265,051	13,265,039
Foreign Countries	50,123	49,217	41,949	59,961
Total shipped from cement plants	10,135,000	10,113,000	13,307,000	13,325,000

Production and stocks of clinker, by months, in 1928 and 1929 (In thousands of barrels)

Month	Production		Stock end of Month		Month	Production		Stock end of Month	
	1928	1929	1928	1929		1928	1929	1928	1929
January	11,839	12,041	9,672	9,642	July	15,981	.....	11,707	.....
February	11,363	11,255	12,237	12,436	August	16,202	.....	9,357	.....
March	12,501	12,450	14,463	14,948	September	15,909	.....	7,566	.....
April	13,844	14,166	15,002	15,472	October	15,782	.....	5,944	.....
May	16,025	15,445	14,329	14,905	November	14,930	.....	5,953	.....
June	15,940	.....	12,944	.....	December	13,426	.....	7,422	.....

Production, shipments, and stocks of finished Portland cement, by months, in 1928 and 1929 (In thousands of barrels)

Month	Production		Shipments		end of month	
	1928	1929	1928	1929	1928	1929
January	9,768	9,881	6,541	5,707	25,116	26,797
February	8,797	8,522	6,563	5,448	27,349	29,870
March	10,223	9,969	10,135	10,113	27,445	29,724
April	13,468	13,750	13,307	13,325	27,627	30,151
May	17,308	16,151	18,986	16,706	25,984	29,597
June	17,497	.....	18,421	.....	25,029	.....
July	17,474	.....	19,901	.....	22,580	.....
August	18,759	.....	21,970	.....	19,374	.....
September	17,884	.....	20,460	.....	16,799	.....
October	17,533	.....	19,836	.....	14,579	.....
November	15,068	.....	11,951	.....	17,769	.....
December	12,189	.....	7,384	.....	22,650	.....
	175,968	.....	175,455	.....	.....	.....

Cement Statistics For May, 1929

The Portland cement industry in May, 1929, produced 16,151,000 barrels, shipped 16,706,000 barrels from the mills, and had in stock at the end of the month 29,597,000 barrels, according to the United States Bureau of Mines, Department of Commerce. The production of Portland cement in May, 1929, showed a decrease of 6.7 per cent and shipments a decrease of 12 per cent, as compared with May, 1928. Portland cement stocks at the mills were 13.9 per cent higher than a year ago.

The output of two new plants, located respectively in Nebraska and Wyoming is included in the statistics here presented which are compiled from reports for May, from all manufacturing plants except two for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 161 plants at the close of May, 1929, and of 157 plants at the close of May, 1928. In addition to the capacity of the new plants which began operating during the twelve months ended May 31, 1929, the estimates include increased capacity due to extensions and improvments at old plants during the period.

New Corporations

Reynolds Falls Asbestos Co., Inc., Globe, Ariz. $250,000. S. J. Brubaker, Los Angeles, Calif.; Graham Foster, Globe, Ariz.

Globe-Los Angeles Mining Co., Globe, Ariz. A. P. Sessions, Pres.; George T. Trowbridge, V. P.; Albert B. Hard, Sec., all of Los Angeles, Calif. Twenty-five asbestos claims at Globe will be developed.

Youghiogheny Crushed Stone Co., James G. Fulton, 2850 Espy Ave., Dormont, Pittsburgh, Pa., $5,000. To quarry and crush stone. James K. Ruby, Treas., 1306 Park Ave., McKeesport, Pa.

Ariel D. Metzger, Inc., Norristown, Pa. $10,000. To quarry stone. Ariel D. Metzger, 100 Buttonwood St.; Ariel D. Metzger, Jr., 119 Buttonwood St.

Kewaunee Gravel Co., Milwaukee, Wis. 200 shares n.p.v.; 200 shares pfd., $100 each. To produce sand and gravel and manufacture concrete products. C. Schneider, G. Wry, H. Gaeth.

Hydraulic Sand Corp., Harry E. Weise, 228 N. La Salle St., Chicago. 4000 shares n.p.v. To produce sand and gravel in Lake Michigan.

United Feldspar Corp., 10 E. 40th St., New York City. Organized to acquire Tennessee Mineral Products Corp., Spruce Pine, N. C.; Oxford Mining & Milling Co., West Paris, Me.; Perham Crystal Feldspar Mines, Oxford Co., Me.; and U. S. Feldspar Corp., Cranberry Creek, N. Y.

Caledonia Rock Products Corp., Bristol, Vt. 100 shares, $100 each. James A. Cannon, St. Johnsbury, Vt.; George F. Badger, Bristol, Vt.

Western Quarry Co., Des Moines, Iowa. $10,000; 100 shares, $100 each. M. O. Weaver, Pres.; John J. Stark, Sec. To quarry rock.

National Stone Quarries Corp., C. J. Tobin, Albany, N. Y. $450,000.

Scranton Gravel Co., Home Insurance Bldg., Little Rock, Ark. $15,000. T. J. Raney, L. P. Biggs.

Bristol Sand & Gravel Co., Philadelphia, Pa. 200 shares com. To operate sand and gravel pits.

Wilcox Sand & Gravel Co., Grants Pass, Ore. $25,000. Roy Wilcox, F. L. Bash.

Iowa Gravel & Fuel Co., Grover A. Blunt, Mgr., 501 Garfield St., Dubuque, Iowa. Formed to succeed Frank Beutin, Inc.

Tennessee-Arkansas Sand & Gravel Co., Arkadelphia, Ark. $50,000. C. C. Hawkins, A. D. Mason, R. W. Huie, Jr.

Bagnell Sand & Gravel Co., Bagnell, Mo. 500 shares n. p. v. Jess Perkins, Gen. Mgr., Bagnell; Burrell McInerney, Albert Tate, Dallas, Tex. To produce sand and gravel.

An Efficient Scraper Hoist

The Gardner-Denver Company is distributing an illustrated, 6-page folder that is mostly concerned with the Model EL2 hoist. This hoist is said to have been designed for the purpose of reducing costs in slushing and scraping operations. The ac motors have two distinct speeds, the lower being half the higher. A powerful and positive hand brake is provided for each drum, in addition to the adjustable mechanism for maintaining the proper tension on the cable. Worm gear construction is used for speed reduction and the reversing mechanism consists of two pawls mounted on two driving arms, which are rigidly keyed to opposite ends of the drum shaft. Most of the moving parts of the machine are lubricated from the center gear housing. The main shaft end bearings and motor bearings are designed for Alemite or Industrial Dot fittings and only require attention once very three months of service.

Exports and Imports

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

Exports of hydraulic cement by countries in April, 1929

Exported to—	Barrels	Value
Canada	4,813	$26,216
Central America	13,186	35,709
Cuba	14,335	30,104
Other West Indies and Bermuda	3,917	9,543
Mexico	4,489	15,294
South America	19,333	77,225
Other countries	4,072	24,225
	64,145	218,316

Imports of hydraulic cement by countries and by districts, in April, 1929

Imported from—	District into which imported	Barrels	Value
Belgium	Florida	1,000	$961
	Massachusetts	23,656	28,966
	New Orleans	4,170	5,044
	New York	6,250	7,241
	Oregon	6,000	6,781
	South Carolina	10,000	12,073
	Total	51,076	61,066
Canada	Maine and New Hampshire	6	19
Denmark	New York	9,124	9,497
	Porto Rico	13,160	19,227
	Total	22,284	28,724
Germany	Los Angeles	1,000	2,443
United Kingdom	New York	15,302	22,029
	Grand total	89,668	114,281

Exports and imports of hydraulic cement, by months, in 1928 and 1929

	Exports				Imports			
	1928		1929		1928		1929	
Month	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	56,400	$204,875	78,639	$283,002	234,753	$342,797	151,302	$177,976
February	62,828	221,620	58,886	225,590	164,408	217,525	118,930	123,123
March	74,983	265,719	69,079	235,164	235,930	330,074	131,909	112,788
April	61,676	205,882	64,145	218,316	249,458	324,371	89,668	114,281
May	70,173	236,005	.....	.....	190,509	256,872	.....	.....
June	59,536	201,313	.....	.....	266,537	359,637	.....	.....
July	83,759	291,055	.....	.....	112,887	151,877	.....	.....
August	88,736	302,866	.....	.....	259,988	358,858	.....	.....
September	71,995	252,843	.....	.....	173,439	226,295	.....	.....
October	62,137	246,010	.....	.....	152,210	226,909	.....	.....
November	69,313	260,310	.....	.....	67,240	92,468	.....	.....
December	63,120	250,204	.....	.....	175,992	233,300	.....	.....
	824,656	2,938,702	.....	.....	2,283,351	3,120,983	.....	.....

Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico, in April, 1929

	Barrels	Value
Alaska	1,662	$4,994
Hawaii	24,248	55,000
Porto Rico	1,272	3,100
	27,182	63,094

Production and stocks of clinker (unground cement), by districts, in May, 1928 and 1929 (In thousands of barrels)

	Production		Stocks at end of month	
District	1928	1929	1928	1929
Eastern Pa., N. J. and Md.	3,650	3,463	2,267	2,616
New York and Maine	1,192	1,089	1,042	1,382
Ohio, Western Pa. and W. Va.	1,686	1,591	1,903	1,804
Michigan	1,270	1,229	1,879	1,376
Wis., Ill., Ind. and Ky.	1,857	1,946	2,012	2,356
Va., Tenn., Ala., Ga., Fla. and La.	1,247	1,144	964	1,225
Eastern Mo., Ia., Minn. and S. Dak.	1,596	1,491	1,011	1,157
Western Mo., Neb., Kans. and Okla.	1,098	1,094	580	751
Texas	546	617	179	188
Colo., Mont., Utah and Wyo.b	285	323	421	533
California	1,243	1,067	1,437	933
Oreg. and Wash.	355	391	634	584
	16,025	15,445	14,329	14,905

Relation of Production to Capacity

	May		April,	March,	February
	1928	1929	1929	1929	1929
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
The month	86.6	76.4	67.1	47.4	44.8
The 12 months ended	73.9	70.2	71.1	70.9	71.0

Stocks at

PIT AND QUARRY FOREIGN DIGEST

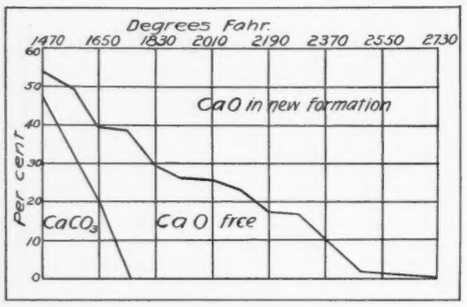


Fig. I

Reburning Cement

The free lime contained in powdered cement clinker can be made to enter largely into combination with the clayey constituents of the cement by a reburning process. If all of the CO_2 present in combination has been fully liberated, about one-half of the free lime content combines with the clay. Adduced evidence indicates that the formation of the active constituent of portland cement takes place by the prior formation of compounds with a low lime content from which the substances rich in lime are formed. Formation of dicalcium silicate occurs between 1,800 and 2,200 degrees F. Bringing a "sinter-melt" to a temperature of about 2,200 degrees F. effects a fairly vigorous lime fixation, in which the intermediate compounds calcium silicate and calcium aluminate are transformed to the clinker minerals, alite and celite. The quantity of free lime, which combines with the clayey constituents on reburning the powdered clinker between 2,200 and 2,600 degrees F. is greater in every case than can be formed by dicalcium silicate the chief constituent of portland cement clinker. The course of this lime fixation is in complete accord with the assumption that alite is a series of mixtures of tricalcium silicate and "Jäneckite" or, mathematically, as a series of mixtures of tricalcium silicate and dicalcium aluminate. Celite appears to be a series of mixtures of dicalcium ferrite and the compound 4 CaO, Al_2O_3, Fe_2O_3—or mathematically, of dicalcium ferrite and dicalcium aluminate. Figure 1 is a typical result of heating a cement flour up to 2,700 degrees F., showing the amount of the lime present, as $CaCO_3$, free and combined lime at the various temperatures. Dr. Hans Kühl (*Zement*, May 9, 1929).

Lime and Cement Kilns

In the manufacture of lime and cement the raw materials in slurry or powdered form are injected into shaft *a*, Figure II, through nozzles *e* at the base and pass upward and downward through a combustion zone which is formed in a substantially horizontal plane by oil, coal or other burners *h*. By adjusting the velocity of projection in relation to the state of subdivision of the raw materials the particles can be kept in suspension until clinker is formed. Supplementary air, preferably heated by contact with the discharged clinker, may be delivered to the upper part of the shaft to agitate the suspended particles. The burners are arranged in two opposed pairs with the jets for the slurry, etc., between the pairs and at a lower level, and the angle at which the slurry, etc., is injected may be varied by adjusting the jets. The waste gases may be withdrawn from the furnace by a fan, and may be utilized together with air, heated by the discharged clinker, for heating a boiler. In a modification a single horizontally-arranged burner delivers tangentially into the shaft. A. C. Davis (British Patent 307,763).

Slow Setting Cement

A slow setting cement having high initial strength is formed by increasing the alumina content of portland cement and adding a protective colloid such as albumin, casein, gelatin, gum, algae or starch. Bauxite may be added to the raw materials, or calcium aluminate may be added to the burned materials during or after grinding. The colloid may be added dry or may be mixed with the gaging water.—E. Goffart (British Patent 294,111).

Manganese in Cement Clinker

Cements containing up to 10 per cent manganese were produced and examined, this substance having been found in appreciable quantities in cements having desirable properties. It was found in normal portland cement clinker that the manganese is combined in the form of manganic oxide. Mn_2O_3 influences the iron oxide content of cement to a great degree and over a wide range. It is possible to obtain high quality special cements, therefore, not only by raising the iron oxide content as Kuhl recommends, but also by increasing the manganese. Kuhl's iron modulus is therefore altered to an iron-manganese modulus:

$$\frac{Al_2O_3}{Fe_2O_3+Mn_2O_3}$$

In normal high lime clinker, the manganese is contained in the heavy, colored constituent, celite. This material is a compound of the type, 2 CaO. R_2O_3 mixed with a calcium aluminate and with bicalcium ferrite. In cements rich in Mn and poor in Al, the Mn exists also in quadrivalent form. If, in a normally prepared and burned clinker, the number of moles of lime are calculated, necessary for combination in the form of celite and tricalcium aluminate, fixing the lime in excess of this amount as not more than three times the silicic acid present, it is possible to produce a clinker containing no free lime, as the formation of tricalcium silicate is the best means of absorbing the excess lime.

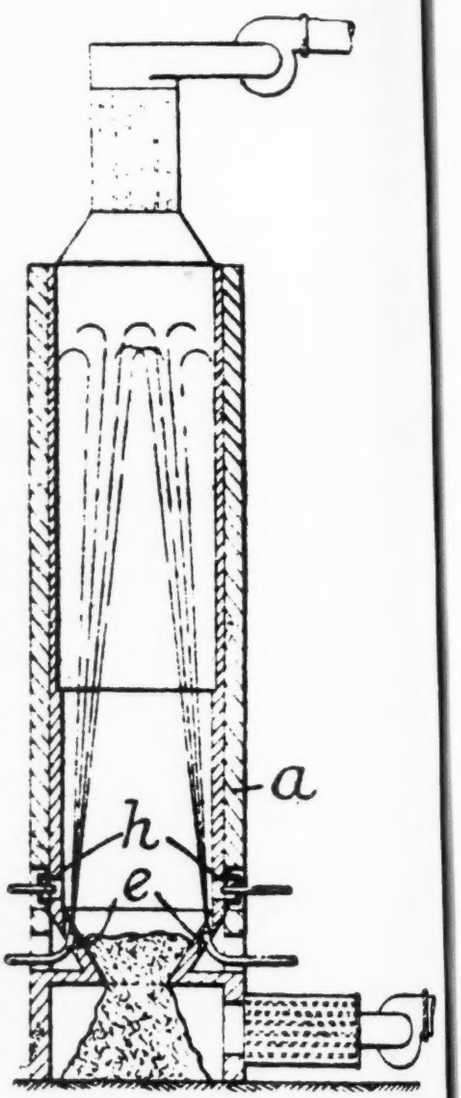


Fig. II

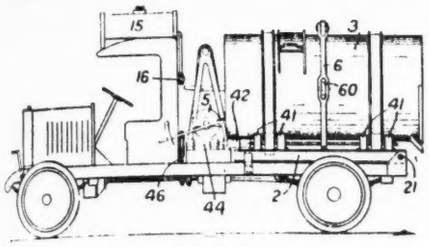


Fig. III

Concrete Mixers

A mixer for simultaneously transporting and mixing concrete comprises a motor-vehicle on which is mounted a horizontal rotating cylinder which can be tilted for discharging about a transverse axis at the rear of the vehicle; a water tank is carried by the vehicle and the mixing is preferably effected near the end of the journey. The cylinder *3*, Figure III is carried on a cradle *2*, and is rotated from the engine by chain gears *46* operating longitudinal shafts *44* which actuate rollers *41* through hand-operated clutches *42*. The cradle *2* is tilted about an axis *21* by means of elevating gear *5*, and is retained on the cradle by a band *6* fitted with rollers *60*, normally out of contact with the cylinder. Water is supplied from a tank *15* through a valve *16*. The cylinder is provided with inclined vanes, and the driving-gear may comprise bevel gears on the pivoting shaft *21*, whereby the cylinder may be rotated during the tilting operation.

Watertightness of Paper Sacks

Transportation of cements overseas, where they are subjected to very humid conditions and possibly to contact with water, makes the watertight properties of the sacks employed of importance. If a small quantity is placed on the paper to be tested, and the lower side of the paper put into contact with water for a definite interval, the residue on the 4,900 mesh sieve serves as a determination of the permeability of the paper. Similarly, if phenolphthalein is added to the water, the elapsed time necessary for the aqueous layer to turn pink is a criterion of its tightness. Colored sack paper was found to be less watertight than the ordinary brown variety. Paper made from mixed sulphite and soda cellulose stock was found of greater impermeability than that from pure soda cellulose alone. The water permeability of sack paper furnishes a criterion for the determination of the porosity of paper sacks. Curt Prussing, (*Zement*, May 2, 1929).

Slag in Cement

The characteristics of a blast furnace slag which will form a good addition for portland cement concrete are: (1) No deleterious impurities should be present. (2) The hydraulic modulus should be equal to or less than 1.1-1.2, i. e.: $\frac{CaO+MgO}{SiO_2+Al_2O_3} = 1.1\text{-}1.2$. (3) The grain size should be as follows: 40-65 per cent to pass a 7 mm. mesh screen, 15 per cent of which should be finer than 1. mm. 25 per cent between 1 and 3 mm., and 20 per cent from 3-7 mm. W. Kosfeld (*Stahl und Eisen* 49, 243-249, 1929).

Packing Cement

Dry pulverized cement is packed by compression into a suitable mold to form a block, or briquette, and then enclosed in a paper wrapper. K. Christensen (Denmark) (British Patent 307,970).

Production of Hydraulic Slaked Lime

The raw material is burned in rotary kilns at about 1000 to 1100 degrees C. Powdered coke is the fuel. The charging is so completely automatic that the entire operation requires only mechanics to oil and otherwise tend the machinery, and one workman for each kiln. The burned lime is discharged automatically onto a travelling belt, which takes the lumps to a crusher. It is crushed to pieces of 10-15 mm. cross section and taken by means of a bucket conveyor to the slaking equipment. The slaking is performed by sprays playing on the moving material, regulated so the correct amount of water will be absorbed. The slaked lime falls into concrete bins of large capacity, lined with chamotte. The lime disintegrates on slaking, to a fine powder, the temperature rising to 450 degrees C. The steam evolved at this temperature helps to slake any overburnt lime present and to hydrate the silica present to a form which combines readily. It is desirable to hydrate the difficultly reacting overburnt lime to avoid the familiar efflorescence which often occurs on brick walls after several months' exposure. To avoid this danger, the lime must not be burned at too high a temperature, it must be well slaked, stored as long as possible in the slaking silo, and finely ground after the storage. W. Marschner. (*Tonindustrie-Zeitung*, May 2, 1929.)

Porous Building Material

Mineral substances, such as natural or artificial clay mixtures, which do not set on mixing with water, are mixed with burnt clay, sand and a froth forming substance.—E. C. Bayer. (Austrian Patent 106,712.)

Fused Aluminous Cements

The reducing impurities in fused cements prepared from bauxite or from slags produced in the manufacture of phosphorus or phosphoric acid from mineral phosphates are eliminated by treating the melted mass with oxidizing agents, which may be gaseous, as oxygen or carbon dioxide, or solid as manganese dioxide or iron oxide. Soc. A'Etudes Chimques p. L'Industrie (British Patent 298,637).

Cement Guns: Mixing

A mortar, cement or like mixing and spraying device has a mixing chamber *2*, Figure IV, disposed directly over the ejecting chamber *3* in the same container, flap valves *7* being positioned between to allow the passage of the mixed material from the mixer to the ejector *3*. The material is fed into a triangular skip *13* which is then raised on an inclined hoist *19*, the valve *16* of the skip automatically opening at the top of the hoist to allow the material to discharge into a hopper *22*. The valve *9* of the hopper is maintained closed by air pressure in the mixing chamber which causes the flap valves *7* to open, but on closing these flap valves the air pressure in the mixer is released thus allowing the valve *9* to open by gravity and the mixer to be recharged. The valve *9* and the flap valves *7* are closed by hand and while one batch is being ejected another batch is being mixed. The mixing paddles are rotated through gearing from a motor *15* and the material is fed for spraying through the tube *6* by a pneumatic motor *4*. L. Krause (German Patent 304,942).

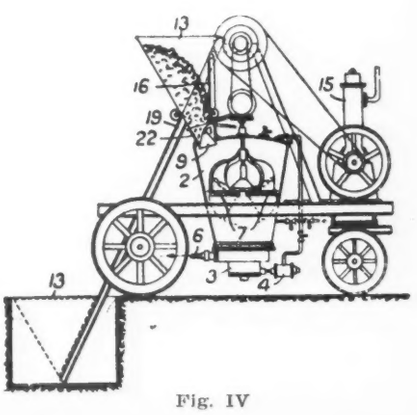


Fig. IV

INTIMATE NEWS OF MEN AND PLANTS

Improvement Company Acquires Stone Supply

The Albany Crushed Stone Company of Albany, New York, was recently acquired by the Callanan Road Improvement Company of South Bethlehem, New York.

Newaygo to Open New Plant

The Newaygo Portland Cement Company will soon start work on a new plant at Charlevoix, plans for which have been in abeyance for some months. J. B. John is general manager.

Waukesha Lime Detonates Huge Blast

A blast of dynamite recently made in the quarry of the Waukesha Lime and Stone Company, Waukesha, Wisconsin, released approximately 110,000 tons of rock. The round comprised 128 holes each about 36 feet deep, and the total cost of the blast was about $5,500.

New Lime Plant To Start Operations

The Standard Products Company of Medford, Oregon, is making preparations to start its new lime plant. The Standard Products Company has taken over the Standard Roofing and Builders Supply Company and will use its offices as headquarters.

Bon Ami Operates Feldspar Plant

For the sole purpose of supplying material for the manufacture of Bon Ami, the well-known polishing and scouring medium, the Orford Soap Company operates a plant at Manchester, Connecticut, mining and pulverizing feldspar, under the superintendence of W. W. Robertston.

Owners Plan Expansion Of Paducah Plant

Expansion and improvement of the facilities of the Ohio River Sand and Gravel Company of Paducah, Kentucky, to the extent of $350,000 will be made in the near future, according to an announcement by L. T. McCourt, of Memphis, vice-president of the company. Mr. McCourt was recently in the city in consultation with local managers of the plant concerning the expansion program.

"Believing in the future of Paducah, West Kentucky and West Tennessee, the new owners of this already large company are drawing plans for a screening and washing plant which will cost approximately $100,000," Mr. McCourt stated, according to the *Paducah Sun*.

"A new all-steel suction dredge will be added to the company's river equipment. Power for this dredge has not been decided upon, but will be either steam or diesel. The pumps will be electrically operated. Dredging capacity will be 350 cubic yards per hour. Living quarters will accommodate a crew of sixteen. Six steel barges will be added to the fleet of nine now in operation. Modern unloading and storage facilities will be built at an expense of approximately $100,000."

Mr. McCourt pointed out that the company is also considering the advisability of adding a fleet of trucks to its equipment. If this feature of the business is gone into a popular brand of portland cement and brick cement will be included.

The present capacity is about 200,000 tons annually, and with the additional facilities the Paducah plant will have a capacity of approximately 500,000 tons of sand and gravel a year.

The Paducah plant was purchased on February 1 of this year from Captain Bob Noble. The plant of the Ohio River Sand and Gravel Company is part of a consolidation of nine large sand, gravel and crushed stone companies on the Mississippi and Ohio rivers, representing a capitalization recently enlarged from $360,000 to $2,560,000.

It is contemplated, according to Mr. McCourt, the capacity of the consolidated companies will run to about 3,000,000 tons of sand and gravel annually. Mr. McCourt said in a statement that the general offices of the consolidated companies will be in Memphis, while the operating headquarters of the northern group of plants will be maintained in Paducah.

March Construction Company Building New Plant

Operations of the March Construction Company of Spokane, Washington, on the limestone deposit recently leased from the Oregon Lime Products Company started operations early in June. The company, which leased the plant on a royalty basis in April, has had a crew at work since that time installing crusher equipment and getting ready for operations.

The output will be chiefly agricultural lime, with chicken grit as a sideline. The plant has a capacity of 300 tons per day of pulverized lime rock.

The quarry and plant are located on what is known as the cement spur, near the Oregon-Portland Cement Company quarries, lying a short distance north of the Dallas-Falls City road, about three miles from Falls City, Oregon.

Under the lease, the March Construction Company is handling operations, sales and all other details of getting out the limerock.

Experiments, covering a number of years by the extension service of O. S. C., the state of Oregon in connection with its lime plant at the penitentiary and progressive farmers, have shown that lime rock will produce exceptional results in bringing many valley soils back into profitable production.

Arizona Asbestos Claims To Be Developed

There is to be development of the Velvet group of twenty-five asbestos claims by the Globe-Los Angeles Mining Company of Los Angeles, California. The organization is officered by A. P. Sessions, president; George T. Trowbridge, vice-president; and Albert B. Hard, secretary, all of Los Angeles. Work is to be under charge of Mr. Sessions, a graduate engineer. The property lies in the McMillin district, north of Globe, Arizona. About $25,000 is to be spent in extending considerable exploration that has been done on the ground, into what are described as large and valuable asbestos deposits.

Reubens Joins Staff Of Arizona Company

George A. Reubens, recently of Los Angeles, has been added to the administrative force of the Slag Paving Brick and Products Company of Globe, Arizona which has broken ground for a large plant, below the Old Dominion slag dump, at the northern edge of Globe. By September 1 it is expected that the capacity output will be reached of 166,000 brick a day, mainly for shipment on Coast contracts. There is to be a 120-foot reverberatory furnace, flanked by thirty annealing ovens, with capacity for 500 tons of slag a day, taken out by steam shovels. Fire brick linings will cost $40,000.

Michigan Governor Signs Mineral Development Bill

Development of mineral rights on a large scale in Michigan has been made possible in a bill recently signed by Governor Fred W. Green which permits the conservation department to sell or lease mineral rights and requires that the owner of land previously purchased from the state shall have the first right of purchase.

The bill was designed especially to open up valuable limestone deposits in the district from Alpena to Rogers City, where Henry Ford and others have been prevented from developing property because the state could not dispose of its mineral rights. It also affects numerous other prospective developments in minerals and oil.

Bridgeport Construction Purchases Large Connecticut Interests

Robert Emmett Donnelly, president of the Bridgeport Construction Company, has purchased the George T. McCarthy Company, and has taken over all local agencies for sand, gravel and trap rock held by McCarthy.

These agencies include McCarthy's franchise for the exclusive distribution of Long Island washed sand, product of the Seaboard Sand and Gravel Company, New York City, and the exclusive territorial rights for New Haven trap rock, product of the New Haven Trap Rock Company, subsidiary of the C. W. Blakeslee and Sons Company.

The six-year lease held on the Housatonic Avenue yards of George T. McCarthy, Jr., which includes the Sykes dock, fronting on the Pequonnock river, has been assumed by Mr. Donnelly.

Feldspar Mill Starts

The Southern Feldspar Company, Incorporated, of Toecane, will begin grinding at its new mill July 1. The mill will have a daily output of 70 tons of pottery ground feldspar or 150 tons of coarse glass feldspar. It will start at once the construction of a storage plant large enough to store 5,000 tons of ground spar so it can have material on hand for the buyers at all times. It is the intention of the company to add more units to the plant at Toecane in the near future.

The company has leased from Aaron Buchanan, of Hawk, the Staggerfork mine, located two miles above Hawk on Cane Creek mountain. This mine was estimated by Mr. Reese, geological engineer of Washington, District of Columbia, in 1925 to be the largest deposit of feldspar in America, the vein showing to be almost solid for 1½ miles in length and 500 feet high. This company has thoroughly tested the feldspar and finds that it is number one in quality. Work will be started at once on a hard surfaced road from Hawk to the mines at an approximate cost of $5,000. When this is completed, the company will install modern machinery and employ about 75 men at the mines to start and as business demands, will increase the force. The Southern Feldspar Company is the largest independent grinder of feldspar in the United States.

National Lime Makes Surveys of Lime Properties

The National Lime, Cement and Byproducts Corporation, of Buffalo, New York, is making surveys for a new plant to be erected on the Tennessee river, near Tuscumbia, Alabama, where the company owns 312 acres of lime rock. The surveys are in charge of Thomas K. Morris, Sheffield, Alabama, who is vice president and manager of production for the company. The first unit of the proposed plant is to have a capacity of 100 tons of lime a day and, according to present plans of the company, is to be completed by January, 1930. Soule and Zepp, Incorporated, of Baltimore, Maryland, will be the engineers in charge of the construction of the plant. Francis L. Hoff, of Buffalo, is president.

Cement Officials Renamed

At the annual meeting of the Peerless Egyptian Cement Company, held in Detroit recently, the following officers were reelected: W. M. Hatch, Detroit, president; L. A. Beeghley, Youngstown, Ohio, chairman of the board; Charles Schmutz, Youngstown, vice-president; S. R. Livingstone, Detroit, secretary; J. C. Baker, Detroit, assistant secretary and treasurer; and M. W. Mills, Detroit, assistant treasurer. The operations are in Detroit and Port Huron, Michigan.

Feldspar Corporations Merge

The United Feldspar Corporation, a Delaware Corporation, has acquired the capital stocks of the Tennessee Mineral Products Corporation of Spruce Pine, N. C., the Oxford Mining & Milling Company of West Paris, Maine, the Perham Crystal Feldspar Mines of Oxford County, Maine, and the United States Feldspar Corporation of Cranberry Creek, Fulton County, New York, thereby bringing under one head such well known brands of Feldspar as Minpro, Oxford Crystal, Cranberry and Kennyetto.

Biospar Crystals, a product used in concrete facing and for the manufacture of shingles, is also produced by this Corporation.

The Roessler & Hasslacher Chemical Co. of Number 10 E. 40th St., New York City, is sole sales agent for the products of the merger corporation.

The corporation has begun the enlargement of one of its plants and has plans under way to double the capacity of the Maine plant and install an aerial tramway from the quarry to the mill. The New York Office of the United Feldspar Corporation will be at Number 10 E. 40th St., after June 10, 1929.

Lime Plant Added To Globe Industries

A new industry for Globe, Arizona, is the installation of a novel lime burning plant on Old Dominion ground, on Copper Hill, by the New Process Lime Company. The product is to be used in the Miami smelters and is believed to be superior to the raw lime rock now consumed as flux.

New Gravel Pit Now Being Worked

The Decatur Hydraulic Sand and Gravel Company of Decatur, Illinois, has finished pumping dirt out of its gravel pit and is producing sand and gravel from the property.

A. P. Bick has been appointed district engineer of the Finishing Lime Association of Ohio, with offices in the Builders building, Chicago. He will represent this association in the district embracing Chicago, Minneapolis, St. Paul and northwestern Indiana and Wisconsin.

L. L. Iddings has been appointed manager of the slag department of the Sloss-Sheffield Steel & Iron Co., of Birmingham. Mr. Iddings formerly held the position of manager of the Alabama Sand & Gravel Co. of Montgomery.

The Rubin Mica Company of Sylva, North Carolina, has sold its holding of 2,200 acres to a company for which Grant Lowe is to be manager and which proposes to erect a sheet mica and grinding plant.

Producers reported stocks of 2,520 tons of crude magnesite at plants on December 31, 1928.

NEWS OF EQUIPMENT MANUFACTURERS

Long Company Opens Office in Allentown

The M. A. Long Company has announced the opening of offices in the Commonwealth Building, Allentown, Pennsylvania. A. E. C. Machin, who for some time has been in charge of building construction for the M. A. Long Company, will be resident engineer. The M. A. Long Company also maintains offices in Baltimore, Washington and Chicago for the service of its clients.

The establishment of this new office in the Commonwealth Building at Allentown marks the rapidly expanding activities of the M. A. Long Company in the Allentown district, and assures those in the cement, grain and general building field the personal service and cooperation of an engineer of recognized ability. Mr. Machin represents one of the largest builders of cement plants, grain elevators, office buildings, schools, churches and kindred structures in the country. One of the M. A. Long Company's largest building contracts was the Baltimore and Ohio Grain Elevator. Another large one was the Keystone Portland Cement plant at Bath, Pennsylvania, recently completed.

Blue Bell Lime Company Uses Scheinert Motors

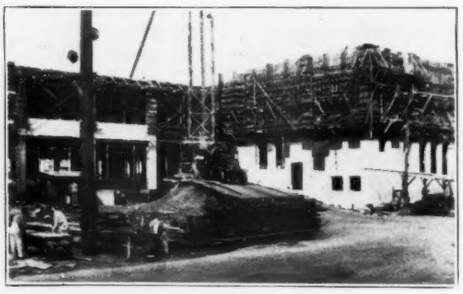
In our issue of May 22 we published an article about the plant of the Blue Bell Lime Company near Philadelphia. The author of the article omitted, unintentionally, to mention the electric motors all of which, we are informed by R. Scheinert, were furnished by his company.

Foote Bros. Establishes Western Sales Office

Foote Bros. Gear and Machine Company has established a western sales office at 1855 Industrial Street, Los Angeles, California, with E. D. Bennett in charge of the reducer and gear division and A. N. Henderson in charge of the road machinery division.

New Method Produces Smooth Concrete Finish in Single Operation

A new method of placing concrete in one operation to achieve a perfectly smooth finish that presents the appearance of perfect masonry finish for exteriors and an absolutely smooth finish for interiors, has recently been evolved and is being used in Los Angeles and Oakland, California.



Factory Building Being Constructed with Transit-Mixed Concrete. Note Smooth Corner

The system, originated by the Scofield-Twaits Engineering and Construction Company, is exceedingly simple, comparatively inexpensive, and it saves the labor and time as well as the cost of refinishing the concrete surface. An excellent example of this new process is in the recently constructed factory building at 54th Avenue and Russell Street, Oakland, California. This is a three-stored structure of reinforced concrete, designed by Francisco and Jacobus, architects. Eight thousand cubic yards of concrete was furnished by the Hutchinson Company of Oakland, operating on this job a fleet of eight Paris transit mixers, pouring an average of 400 cu. yd. in eight hours. The illustration shows a corner of the exterior finish; the same smooth surface was obtained throughout the job, no refinishing being necessary.

Here is how this masonry finish was obtained. Strips of molding were nailed to squares of pressed wood. These squares, about 4 ft. by 6 ft., were then placed in the forms and the concrete poured in the usual manner. After two or three days, the forms were taken down and the pressed wood squares used on another part of the job. The advantages of pouring and securing a perfectly smooth finish in one operation without the added cost of finishing, are readily apparent.

On this job transit system mixed concrete was used exclusively. The specifications called for the ordinary 1:2:4 mix with three per cent of diatomaceous earth.

Industrial Equipment Illustrated to Create Interest

The Standard Boiler and Steel Works, which is successor to Fulton Engine Works Plate Shop, Ajax Tank and Pipe Works, Darby Boiler Works and the Pioneer Boiler and Machine Works, is distributing an illustrated 20-page booklet. As pointed out in the foreword, it is complete camera evidence of the ability of this company to construct efficient machinery for scores of different industries. There is little description in the booklet, but the company is in a position to provide any desired description as required by interested parties. Among the illustrations of interest to nonmetallic producers are speed reducers, screens, pebble mills, ball mills, hammer mills, vertical kilns, revolving kilns, coolers, dryers, bins, power plants, concrete mixers, delivery tanks, hoppers and ramps.

Governors and Unloaders For the Industries

The Jarecki Manufacturing Company has published and is distributing a number of illustrated circulars that describe the governors and unloaders, manufactured by the company. This equipment is especially designed for the different duties outlined in the literature. In addition, this company manufactures iron and brass valves, malleable and cast-iron fittings, brass fittings, pipe vices, screw plates and pipe-threading machines.

Construction Machinery Concludes Agency Arrangements

The Construction Machinery Company announces that the following agency connections have been made for handling the entire line of Wonder tilting mixers, Marsh-Capron drum type mixers, CMC builders hoists, Kern variable speed drag scraper hoists, Wonder contractors pumps, mechanical Hoeman plaster mixers, and power sawyer saw rigs: George V. Treen, 520 Monroe Building, Charleston, West Virginia; Bournival and Company, 336-340 Notre-Dame E., Montreal, Canada; Construction Equipment Company, 310 Dooly Block, Salt Lake City, Utah.

Bucyrus-Erie Official Dies

George F. Kent, manager of industrial relations for the Bucyrus-Erie Company, South Milwaukee, Wisconsin, died suddenly on May 22 at his home. Death was caused by a heart attack. Mr. Kent was a member of the operating board of the Milwaukee Association of Commerce, and had been employed by the Bucyrus-Erie firm for 28 years.

Chain for Cranes, Dredges And Heavy Duty

An interesting and helpful pamphlet, bearing the above title has just been issued by American Chain Company, Incorporated. It contains tables showing the number of links per foot, weights, proof tests and safe working loads of the different sizes of crane or dredge chain and other information which buyers and users of chain will find valuable for their files. Copies may be obtained, without charge, by addressing a request to American Chain Company, Incorporated.

Dryers, Coolers and Kilns

The Standard Boiler and Steel Works is distributing a catalog that illustrates dryers, coolers and kilns for all industrial requirements. It gives a resume of the progress of the company, contains illustrations of installations and states that the field is too large for detailed data on each design to be included. An inquiry sheet is attached for the convenience of those interested from which information the engineers will compile the necessary data.

A Reminder

The Bodinson Manufacturing Company is mailing a 4-page illustrated bulletin to remind the industries that it specializes in many types and classes of modern machinery. These include different types of screens, washers, conveyors and completely designed and equipped plants. This manufacturer is able and willing to supply information on installations and equipment, together with a free engineering service.

The Hadden Dump Body

The Drake-Williams-Mount Company is distributing a single page illustrated leaflet which describes its Hadden all-steel dump body. This dump body is so constructed that the weight of the load in the body does the work of dumping by means of a release lever. Automatic return of the body is said to be so exact that it can be dumped and restored to position while in motion. The bottom is inclined to give a quick and clean dumping angle.

Whitcomb Company Describes Stone Plant

As a service to its clientele, the Geo. D. Whitcomb Company is distributing an illustrated 8-page folder entitled, "Illinois Electric Limestone Company Operates Modern Crushed Stone Plant." The article in the folder was abstracted from a description, under the same caption, published on pages 65-70 of the January 16, 1929 number of PIT AND QUARRY.

The description is useful to operators and engineers who are concerned with the design or operation of crushed stone plants as it gives full credit to other manufacturers as well as the engineering features of the plant. Two pages of the folder, apart from the plant description, are used to illustrate and describe some of the Geo. D. Whitcomb products.

Jeffrey Appoints Connors Assistant General Manager

The Jeffrey Manufacturing Company has announced the appointment of John L. Connors as assistant general manager of the company. Mr. Connors, who is the son of M. S. Connors, was born in Columbus and was formerly engaged in business there. He was educated at Ohio State University and Purdue University, graduating in 1905 from the latter school.

For the past nine years, he has been president of the Morgan-Gardner Electric Company and comes to the Jeffrey company equipped with broad manufacturing and sales experience. In his new field of activities, Mr. Connors will have special duties and responsibilities in the management of British Jeffrey-Diamond Limited, Jeffrey Manufacturing Company Limited and Galion Iron Works and Manufacturing Company which are subsidiaries of the Jeffrey Manufacturing Company.

New Solutions To Old Problems

The Ross Screen and Feeder Company is distributing a new illustrated 24-page general catalog that is intended primarily to give new solutions to old problems as embodied in its feeder screen, curtain screen and wagon loader. Additional detail and specific catalogs are in state of preparation and will be distributed to the industries on request.

The feeder is built to handle granular material of any size from primary shovel or excavator to the finest pulverized material. Ship-anchor chains, ranging from the smallest steamer up to battleship, are used for the Ross feeders. The illustrations show the behavior and control of materials at hopper outlets and at open dump chutes; eight chief applications of the feeder and typical installations of feeding all styles of crushers, and conveyors; and its application to vertical and hopper outlets, as well as open dump chutes.

Foote Bros. Move

The Foote Bros. Gear and Machine Company announces that its general offices which include all administrative, sales, advertising, accounting, purchasing, production and engineering departments of both the road machinery, gear and reducer divisions were moved from 215 North Curtis Street, Chicago, to 111 North Canal Street. The factory organization will remain at the former address and will be operated from the general offices as one of the five manufacturing units of the company.

The gear and reducer business of the company has increased over 300 per cent in the last five years, and the early part of the year, the company acquired three large companies, engaged in the manufacture of tractors and graders. The new companies include the Northwestern Steel and Iron Company, the Bates Manufacturing Company, and the Stockland Road Machinery Company. These companies have been organized into a new division of Foote Bros. Gear and Machine Company, konwn as The Road Machinery Division. The space occupied by the new general offices of the company is approximately 27,000 square feet, including one entire floor of the large 15 story office building.

Economy Suggestions

The Traylor Engineering and Manufacturing Company is distributing an illustrated 4-page folder captioned "Economy Starts With the Machine." It points out that operators frequently ignore a factor that is productive of unnecessary cost, the retention of old style equipment which does not give required capacity and is constantly in need of repairs. This is not because operators do not know these facts but because they shrink from the cost of replacement with modern equipment, and yet the cost of one shutdown is frequently more than sufficient to pay the interest on the necessary investment. Traylor Engineering and Manufacturing Company will go to any length in assisting any operator to analyze his problem and make recommendations that will eliminate the losses from shutdowns and breakdowns.

Ford Chain Appoints Sales Manager

The Ford Chain Block Company has announced the appointment of C. A. Anderson as sales manager with headquarters at the general offices and works. The company manufactures Tri-Bloc chain hoists, worm gear hoists, differential hoists and Eye Beam Trolleys.

THESE BOOKS SHOULD BE IN *YOUR* LIBRARY!

These books are of practical value to producers of non-metallic minerals. Without them your library is incomplete, and you lack much valuable information.

Indicate on coupon below the books that you need. Sign your name and send the coupon (only) to us, with your remittance to cover and we will ship the books to you promptly.

Pit and Quarry Hand Book

By Twelve Specialists. 1929 Edition. An accepted authority. Treatise including geology, plant design, drilling and blasting, stripping, loading and transporting, crushing, grinding and pulverizing, elevating and conveying, screening and separating, washing and drying, storing and rehandling, dredging, pumping, hydraulic stripping, internal combustion engines, power plant operation, powdered coal, power transmission, speed reducers, burning, waste heat recovery, clinker handling, hydration of lime, lubrication, fire prevention, cost accounting, insurance, shipping data, accident prevention, useful data, statistics of production, etc. Price postpaid in the United States..... **$2.00**

The Engineering of Excavation

By George B. Massey. Facilitates the correct analysis of excavation problems and assists in the selection of the proper type and size of machine for the better and cheaper methods of doing work. It contains original notes obtained first hand in the field, and up-to-date information on present day excavating. Postpaid..... **$6.00**

Portland Cement

By Richard K. Meade. Third edition. Concerned with the composition, raw materials, manufacture, testing and analysis in the Portland cement industry. Contains a wealth of practical information gathered from commercial experience by the author. Postpaid..... **$10.00**

Lime and Magnesia

By N. V. S. Knibbs. Deals with the chemistry, manufacture and use of oxides, hydroxides and carbonates of calcium and magnesium. Postpaid..... **$7.50**

Fuels and Their Combustion

By R. T. Haslam & R. P. Russell. A thorough treatment of the origin, composition and production of fuels and their efficient utilization. The book presents the underlying principles of the science of combustion, describes typical combustion equipment, gives actual plant data, explains common combustion reaction and discusses the flow of air and flue gases and heat transfer. Postpaid..... **$7.50**

Non-Metallic Minerals

By Raymond B. Ladoo. This book covers the technologic, industrial and economic phases of the whole field of the inorganic non-metallic minerals. Over 100 different minerals are covered, with information on the composition, physical and chemical properties, occurrence, geological and geographical distribution, production and consumption, methods of mining and milling, specifications and tests, markets, grades and prices, utilization, etc. Postpaid..... **$6.00**

Directory

Of Cement, Gypsum, Lime, Sand and Gravel and Crushed Stone Plants. 1928 edition contains listing of companies, geographic distribution of plants, officials and operating executives, capitalization and brief description of plant characteristics. Postpaid..... **$5.00**

The Marketing of Metals and Minerals

By J. E. Spurr & F. E. Wormser. The combined work of 30 well-known specialists. Contains 64 authoritative articles concerning the marketing of 94 different metals and minerals. Part I contains essential facts on the Marketing of Metals and Ores; Part II, Marketing of Non-Metallic Minerals; Part III, General Articles. Postpaid..... **$6.00**

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